

• DELAUER ON DEFENSE • CUTTING REGULATORY RED TAPE •

• TAX REFORM: BONUS FOR HIGH TECH •

TechnologyReview

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RELOCATING THE NAVAJO

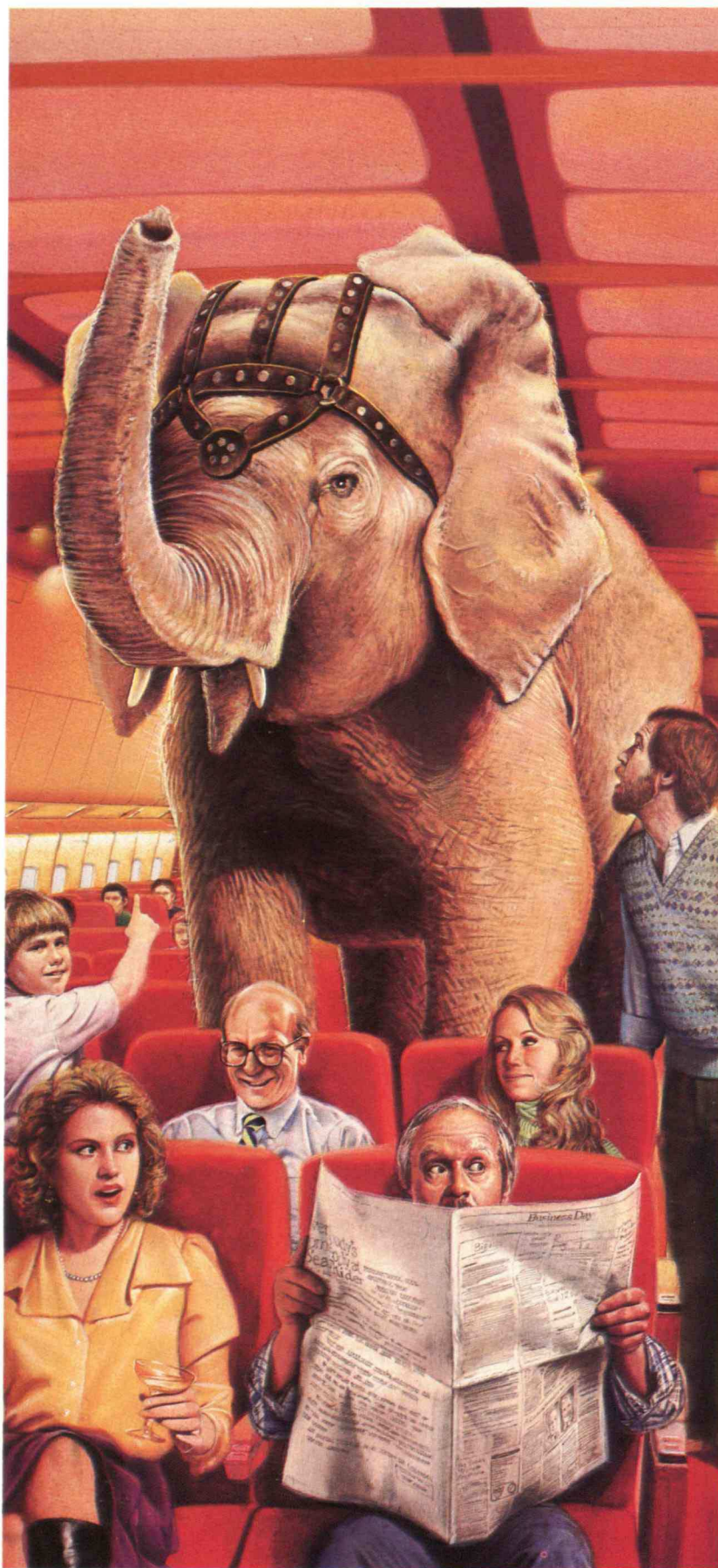
WHEN
TECHNOLOGY AND
TRADITION
CLASH



technology review

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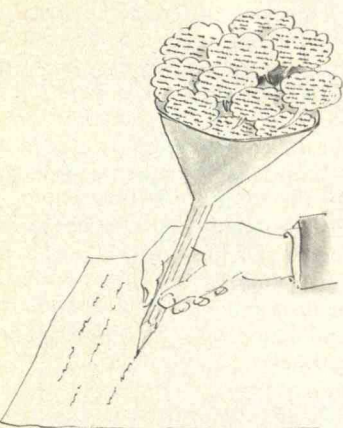
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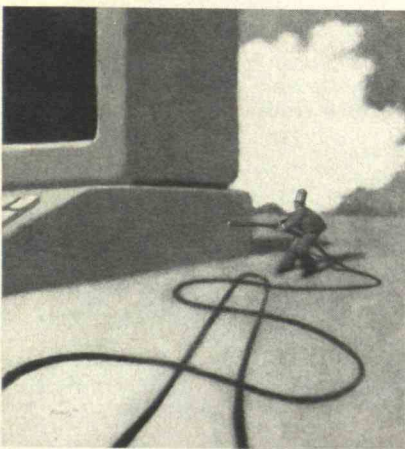
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Lessons from Japan

"By focusing on the broader economic, political, and social issues that center around technology, *Technology Review* is sending warning signals to America about future problems," writes Japanese journalist Takashi Kakuma in *Beruf*, the Tokyo magazine that carries translated articles from the *Review* for Japanese readers. "Just about everything that happens in the United States eventually occurs in Japan," Kakuma warns.

This comment on *Technology Review* and its relevance to Japan as well as the United States was published on the occasion of *Beruf*'s fourth anniversary. Kakuma's remarks came in a dialogue with Yoshiro Hoshino of Teikyo University. Together they speculated on Hoshino's observation that American technology has changed: "It used to be that when a product had 'Made in America' stamped on it, quality was guaranteed."

What has changed? asked Kakuma.

Hoshino's answer: "When American engineers were knowledgeable about production and maintenance problems, they designed products that wouldn't easily break down.

"Now a different America is emerging," he says. For example, General Motors introduced articulated robots on their assembly lines without changing the basic manufacturing processes, without studying the consequences thoroughly beforehand. "This would not have happened in an earlier America."

In other ways, too, says Hoshino, U.S. technology is showing its age. It's focusing, he thinks, too sharply on space, electronics, and biotechnology, and by

emphasizing Star Wars the United States is "taking a chance on falling behind in the industrial technology infrastructure here on earth."

What are the real problems for tomorrow's technology? asked Kakuma.

Hoshino's answer: it may be possible to guide a rocket to its target in space, but "I'll eat my hat if you can operate an automated car from Shinbashi to the middle of Ginza in downtown Tokyo. Issues related to nature and unpredictability... are a challenge that can't be solved by conventional technology."—John Mattill

TWO STAFF ADDITIONS

Our masthead displays two new names this month—Laura van Dam and Beth Horning, associate editors. Van Dam will edit Forum contributions and major articles, working on our contributors' words, while Horning as copy editor will concentrate on improving the editors' efforts.

After graduating in science communication from Boston University, van Dam worked as a reporter for the *St. Petersburg (Fla.) Times* and *New England Business*. Earlier she did editorial work for the New England Wild Flower Society and (as an intern) for the *Christian Science Monitor*. Horning studied and taught English at Indiana University and since 1980 has been working as an editor for various publishers in the Boston area. She writes poetry, essays, and fiction for several newspapers and magazines.

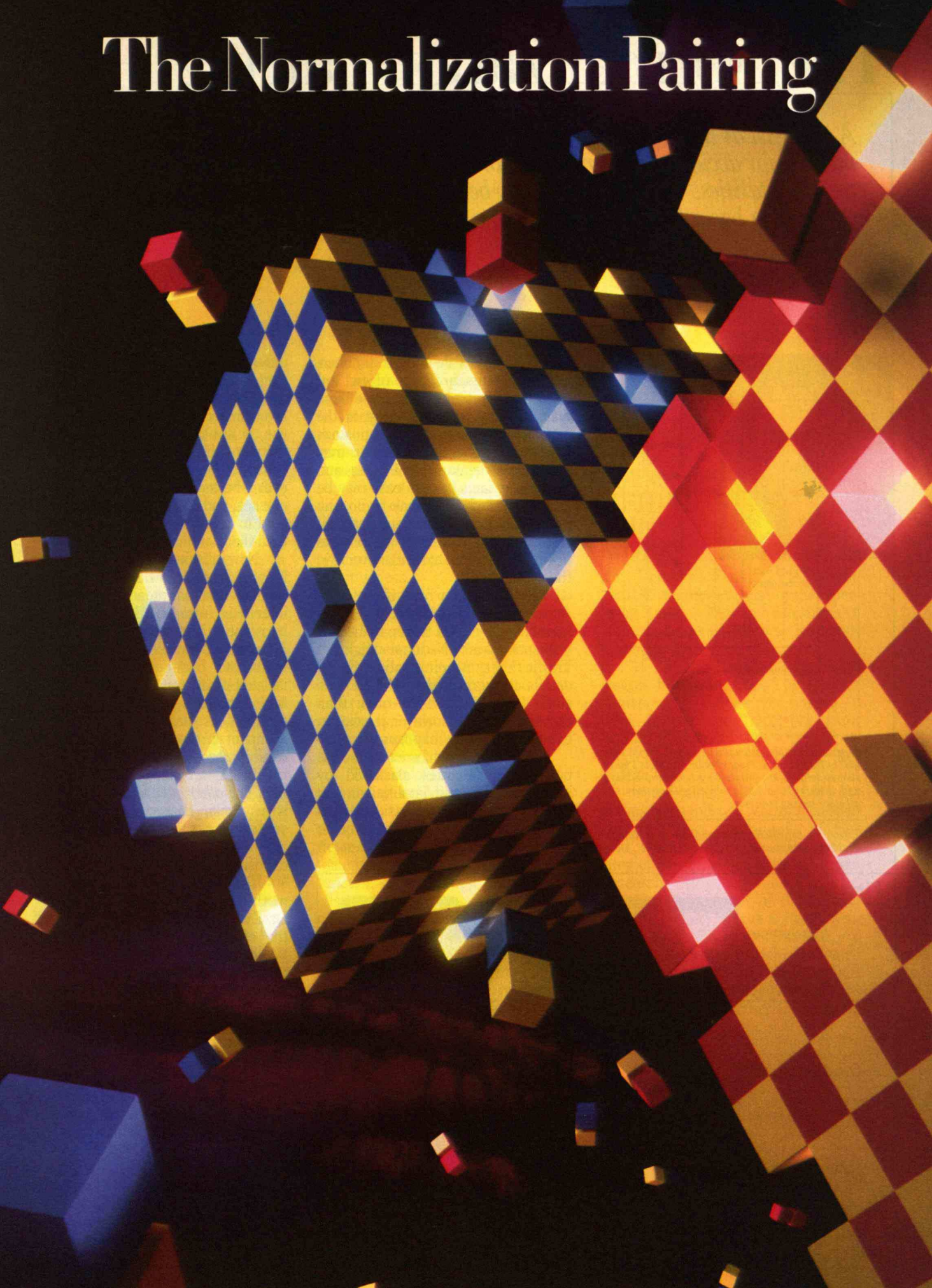
Because of other pressing commitments, Robert Cowen was unable to write his column for publication in this issue.

***Beruf* magazine, which brings the content of *Technology Review* into Japan, celebrates its fourth anniversary.**



PHOTO: KYOKO MAKINO

The Normalization Pairing



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Chemists and the Media

SCIENCE AND SENSATIONALISM

In "Time for Chemists to Pull Their Heads from the Sand" (*February/March*, page 6), Robert Cowen wrongly disparages the National Research Council (NRC) report *Opportunities in Chemistry*. The report's intent was to show how chemistry aids each of us every day—and to counter media sensationalism, which is typified by Mr. Cowen's suggestion that "many people . . . wonder what new chemical horrors are being released daily into the environment." Such sensationalism tends to induce anxiety rather than encourage prudent consideration of the risks and benefits of scientific developments.

As the report states, the public must make choices on its own behalf. Neither scientists nor any other special interest group should be allowed to influence those choices. The electronics engineer who facilitates better television communication is not thereby qualified to decide whether Big Brother, Jerry Falwell, or Robert Cowen should appear on sets in every home.

Scientists do have ethical responsibilities, though. Whenever the public has to make informed decisions, scientists are crucial—not as advocates but as experts. To quote the report, they must supply objective information "in language free of technical jargon." The media must do their part by providing balanced coverage.

Scientists and the media must cooperate. Currently, however, some parts of the media represent the chemistry community as uncaring and irresponsible, and some parts of the chemistry community strongly resent the media's persistently pejorative treatment of news involving chemicals.

A constructive step would be for the media and the chemistry community to engage in an open dialogue on how to communicate with the public about technological benefits and attendant problems. Such a dialogue would be most useful if it were based on the good-faith premise that both the media and the chemistry community sincerely wish to help people. I'm happy to report that such a dialogue will be initiated, with Mr. Cowen as a participant, at the national meeting of the American Chemical Society this September. And I invite interested readers to attend.

GEORGE C. PIMENTEL
Berkeley, Calif.

George C. Pimentel is president of the American Chemical Society and chairman

of the Committee to Survey the Chemical Sciences, which commissioned the NRC report.

PARTICIPATORY MANAGEMENT

In "Pruning Our White-Collar Ranks: A Key to Productivity" (*November/December*, page 14), Lester Thurow suggests that corporations would profit from participatory management, which, in his view, could increase productivity and eliminate superfluous middle management. My own experience with a small specialty-chemicals plant does not bear him out.

When I came to the plant in 1933, it had participatory management: the plant manager spent fully half the working day with the employees. Yet even though participatory management remained in effect, the plant closed forever in June 1985. One reason had to do with the untimely deaths of two key managers. But three other knockout blows came from American industry in general and show why participatory management, valuable as it may be, is usually infeasible in today's business world.

First, since the plant needed substantial funds for technical improvements, traditional financial-management policies began to displace participatory management. The plant began to look for personnel attuned to fiscal management rather than enlightened technical management.

Second, the plant felt the effects of World War II, which marked a critical transition in the nation's economic history. The war spawned a need to train millions of both military and civilian personnel in a short time, and this led to government involvement in civilian affairs. This involvement steadily increased, introducing bureaucracy into the private sector on a very large scale. As a result, plant managers found themselves further and further removed from workers.

Third, the plant's parent corporation, like so many others, moved toward quantitative growth and away from qualitative growth based on technical excellence and participatory management. Much of this action was necessary because of inflation and the instability of interest rates, which put a high premium on immediate profit and discounted the responsibility of both government and industry to provide for the nation's economic and technical future. The upshot has been ever-larger conglomerates and multinational corporations.

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Overexposed in Albuquerque

Albuquerque high-tech workers were exposed to hundreds of toxins, as described in these worker-compensation claims. Now the workers suffer as many health problems.

Yolanda Lozano now has malignant melanoma, a deadly form of skin cancer, and she is convinced it comes from her repeated exposure

GTE spokesperson Nancy Colbert says the lawsuits are "without merit. There are no indications that the materials used at the Albuquerque plant produced the health problems of the plaintiffs." A letter stressing the company's position went to every worker at the Lenkurt plant when the number of suits reached 20. GTE has since shut down most of the plant, but attributes this to industry trends.

Almost 2,000 workers—many of whom are Hispanic women—experienced roughly the same conditions as Lozano did. Varying amounts of over 150 different toxic chemicals were used regularly. Because no department of the modern plant had a local exhaust system, the fumes from these chemicals could recirculate throughout the building. According to Lozano and the claimants' lawyer, Josephine Rohr, many workers were directly exposed to toxins such as polychlorinated biphenyls (PCBs), benzene, and trichloroethylene (TCE), yet GTE issued no respiratory masks or protective clothing.

Most of the ninety-one plaintiffs were healthy before working at GTE-Lenkurt. Now about thirty of them suffer from skin, uterine, ovarian, cervical, colon, breast, brain, and thyroid cancers. The rest complain of other serious problems, including dizziness, bronchitis, infections unresponsive to antibiotics, and deteriorating bones and cartilage. Two cases of an unknown illness resembling multiple sclerosis have been reported as well. Three claimants with cancer have died since the suits were filed. Rohr says that fourteen more of Lozano's co-workers have also died of cancer.

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who started me thinking," Lozano says, "because he said it is very rare for a Hispanic to ever get this type of cancer. He asked me right away whether I spent a lot of time in the sun. I said there's no way I could have because I was normally going into the plant at a quarter of six in the morning and not leaving until my 12-hour shift was up."

Rohr began the legal battle with little local support, and she has faced opposition even from the local chapter of the International Brotherhood of Electrical Workers, which represents the Lenkurt employees. The union overlooked health and safety issues, choosing to fight against layoffs instead. But despite these efforts, GTE has gradually moved most departments from the Lenkurt plant across the border to Juarez, Mexico. Only about 150 workers remain at the Lenkurt plant.

Lozano and Rohr have received assistance from the National Network for a New High-Tech Agenda. Made up of high-tech workers, health and safety specialists, and environmentalists, the group is known informally as the Integrated Circuit. One of its main priorities is the health of high-tech workers.

Integrated Circuit member Nancy Lessin, director of the Massachusetts Coalition for Occupational Safety and Health, has followed the Albuquerque case closely. She notes that doctors, toxicologists, and epidemiologists are showing a growing interest in environmentally induced damage to the immune system. These researchers think they see a pattern in the symptoms of workers exposed to a broad spectrum of chemicals, especially in large doses. "It is an unusual constellation of symptoms," Lessin says, "but

one we are coming to recognize."

The immune system, an extremely intricate biological system, protects the body against disease by identifying potentially harmful alien materials and releasing antibodies to fight them. Albert Levin, a physician at the University of California at San Francisco, emphasizes the ability of large amounts or large numbers of chemicals to break down the immune system. He has coined the term CAIDS—Chemically Acquired Immune Deficiency Syndrome—to describe the variety of symptoms that can result. However, he cautions strongly against comparing CAIDS to AIDS, in which the immune breakdown is rapid and far more extensive.

David Ozonoff, an epidemiologist at Boston Univer-

sity, agrees that researchers are seeing "definite effects on the immune system from chemical exposure." He feels that those effects are just beginning to be understood, but he can see why defendants such as GTE fear evidence that working conditions could cause them: immune deficiency might explain "a whole range of diseases."

The focus on the immune system marks a significant change in research on toxic effects. Until recently, researchers have tried to link specific symptoms to individual chemicals. Many of the symptoms like the ones exhibited in Albuquerque "were previously seen by the medical community to be psychosomatic, or what we call ideopathic [of no known cause]," says Levin. He notes the "growing recognition that

a lot of the cancer we are seeing is related to immune-system breakdown."

So far, it is unclear whether courts and state worker compensation systems will accept any of the theories that connect different diseases with employee exposure to chemicals. After almost two years, the cases brought by Lozano and her co-workers have yet to come to trial.

Levin believes that the public will benefit from the suits regardless of the outcome. "My goal is to make the public recognize the dangers of the indiscriminate use of toxic chemicals. I think the toxic torts arena works faster and more effectively than virtually any other in this respect, certainly faster and more effectively than publishing findings in a scientific journal."—*Seth Shulman*

Lancashire Laundry Day



On the site of an abandoned gasworks in Blackburn, Lancashire, in the British Midlands, biotechnology is being used for the first time to decontaminate spoiled land. The two-year project began this past December. It could be the largest such cleanup operation ever undertaken in Europe or the United States, says a representative of BioTechnica Ltd, the company hired by the Blackburn Borough Council to do the job.

The Greenbank Gasworks closed in the 1970s, when natural gas from offshore fields in the North Sea replaced "town gas" manufactured from coal. The site was left contaminated, primarily with phenols, coal tars, and cyanide.

The idea that microbes could munch through heaps of waste like an army of Pacmen appeals to those who must deal with the excreta of industry. The usual practice of shifting the material from one site to another simply buys time. At Greenbank, BioTechnica employs natural microorganisms from the site itself to completely eliminate the problem.

The technique being used at Blackburn does not rely on genetic engineering to create new organisms. Rather, it focuses on stimulating existing microbes—with improved climates and nutrients—to vigorously attack waste material and contaminants. The first step is isolating microorganisms that have, on a limited scale, already begun the degradation process. According

to John Rees, BioTechnica's environmental program director, such microbes have to exist. "It would be a very strange site that did not have natural microbes."

However, says Rees, they exist in insufficient quantities and conditions for them are usually "unsatisfactory." Therefore, once the active microbes are isolated, they are bred in 150-liter fermenters. Then layers of the microbes go into specially designed mounds built by a team from Miller Buckley Projects, a civil-engineering firm that is undertaking the decontamination with BioTechnica. To provide a better climate for the microbes, tents enclosing the mounds raise the temperature a few degrees. A watered-down mixture of the microbes and soil will be sprayed on the rest of the site.

The bacteria digest the contaminants in the mound, excreting water and carbon

This mound of contaminated land in Lancashire, England, is being sprayed with special microbes to clean it up.



dioxide. Once the mounds are decontaminated, their contents will be spread back on the site, thus conserving the topsoil on the land.

So far BioTechnica has concentrated on organic wastes, like the coal tars and phenols that are residues from the production of gas. Eventually this process could handle some inorganic wastes—such as cyanide—which the microbes could convert into simpler compounds. If these simpler compounds were toxic, another set of organisms could then attack them, causing further conversion. This two-step process is known as “co-metabolism.”

Eventually, genetically engineered bacteria could handle the large amounts of pure waste that often result from chemical processes. For the moment, though, such microbes are not hardy enough to face real-world environ-

mental variables or competition from natural microorganisms.

An additional problem is that certain chemicals are highly toxic even in small quantities, but both engineered and natural bacteria need a certain threshold level of the toxic chemical to be stimulated into activity. BioTechnica intends to develop microbes that could metabolize some of the more common highly toxic chemicals, such as dioxin and polychloride biphenyls (PCBs).

The efficacy of using microbes for cleanup, however, is not yet established. Allen Quirk of the Center for Applied Microbial Research at Porton Down has spent half a decade working on ways to break down many toxic substances. He claims to have seen “a number of transformations of compounds.” But, he reports, he has never seen “complete degradation” of

toxic waste, and he is amazed that anyone is undertaking a major effort to use the technique on an actual industrial site. “We are unsure whether this technique can work in the laboratory, let alone in the field,” he says.

Nevertheless, Quirk believes in the potential of the process. So does Hans Kornberg of Cambridge University, a microbiologist and former chair of the Royal Commission on Environmental Pollution. Kornberg says that the key is to perceive the relationships between communities of microorganisms and understand how those communities cooperate in breaking down a complex pollutant.

Asked if he thinks that biodegradation is the hope for cleaning up contaminated industrial sites and toxic waste dumps, Kornberg replies, “Is there an alternative?”—Steve Sasanow

Egg-Carton Cars

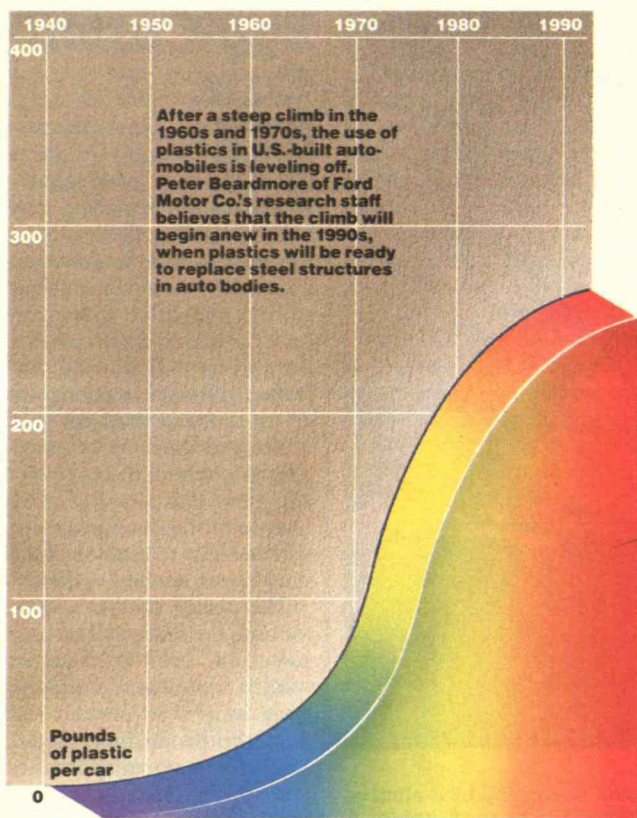
For more than a decade, plastics have been gradually replacing steel in automobiles. Grilles, trim, bumpers, hoods, fenders, and even mechanical parts such as springs and drive shafts can now be made from plastic. But this trend is slowing. Existing plastics have gone about as far as they can go.

Yet the industry is confident that within the next decade new plastics—including fiber-reinforced composites—will be ready to replace all the steel in automobile bodies.

The plastic car has appeal for both the industry and consumers. A 1984 Ford Escort with a hand-made plastic body weighs 30 percent less than the production model, and automakers speculate that weight reductions of up to 50 percent may be possible in the near future. Fuel savings would be considerable, since weight is the major determinant of fuel economy.

Moreover, corrosion condemns many cars with steel bodies to junkyards before their mechanical parts are worn out. Plastic bodies would resist corrosion, and most authorities agree that plastics would resist crash damage better than steel. Eliminating the rust-proofing steel bodies require would save money, too.

Many structures that now consist of several metal parts fastened together could be made as single units if they were plastic. For example, in the Ford Escort prototype one piece of plastic replaces 45 pieces of steel. Peter Beardmore of Ford Motor Co.’s research staff told the American Chemical Society (ACS) last spring, “We can think about



making a car body like an egg carton—a top and a bottom glued together.”

If this vision is to be fulfilled, plastics must match or better steel in three usually incompatible qualities. First, they must be durable, resistant to cracking after repeated stress. Second, they must be stiff, able to retain their shape. Third, they must absorb the force of a crash by bending. Materials that meet these requirements must also be mass producible at the rate the auto industry demands.

At the 1986 international convention of the Society of Automotive Engineers, Allan D. Murray and Derek F. Gentle of Ford's Plastics Development and Application Office said that this tall order requires “a fresh look at the full spectrum of existing and developing materials and processes.” Beardmore is opti-

mistic: “There is clear evidence emerging that composite materials can be tailored to satisfy these criteria,” he told the ACS.

How will the plastic revolution affect the industry? There is one precedent. In the 1920s, pressed steel replaced wood frames for auto bodies. According to Murray and Gentle, that was a “major upheaval”—a sudden and brilliant improvement in strength and durability that no maker could ignore. But very high tooling costs for steel pressings necessitated high sales volumes, so the wood-to-steel revolution played a major role in forcing many famous American marques out of business by the early 1930s. Marmon, Auburn, Durant, Paige, and Pierce-Arrow were among the casualties. If plastics fulfill the promise of low tooling and manufacturing

cost held out by Murray and Gentle, they may lead the industry back to the diversity of a half-century ago.

Repair is not expected to be a serious problem. John V. Werner and Ben C. Parr of the State Farm Insurance Co. told the Society of Automotive Engineers that “passenger cars designed with extensive use of plastic panels can be economically repaired.” Furthermore, most shops know how to do it. However, automakers should clearly identify the material from which each part is made since different plastics need different kinds of repairs. For example, so-called thermoset plastics cannot be welded as can more flexible thermoplastics; on the other hand, dents in thermosets—but not in thermoplastics—can be removed by applying heat.

Unlike steel bodies, plastic ones cannot be easily recycled yet. Simple plastics will probably be incinerated to produce heat, says Professor Michael Bever of M.I.T., an expert on automobile recycling. But new techniques will be needed to manage the plastic bodies that incorporate glass or graphite fibers for strength and stiffness. The fibers interfere with incineration, and if they escape from the incinerator, they could create problems in the environment.

The move to plastics will come more slowly than did the wood-to-steel revolution of the 1920s as the technology develops over the next decade. But in the long term, longer-lived vehicles, a significant decrease in steel demand, a corresponding increase in the use of polymers, and lighter weight all suggest a host of changes that may reach deep into the country's industrial fabric.

—John Mattill

High-Tech House Arrest

A district court judge in New Mexico was reading the comics one hot day in August 1979 when an electronic bracelet Spiderman was wearing caught his attention. The villain had forced Spiderman to wear the device,

HARD AS DIAMONDS:

Imagine putting a hard-as-diamonds finish on your latest clay *objet d'art* with a little paint and a hair dryer. In April, Richard Laine of SRI International told the American Chemical Society that he and his colleagues are approaching this point. Already they can make ceramic coatings in as little as 20 minutes (instead of hours) and at temperatures as low as 450 degrees centigrade (compared with 1,700 degrees).

“Speed and low temperature usually mean lower costs,” he says. “We already use ceramics as coatings when cost is less of a factor, as in the aerospace industry. If we can make these materials less expensive, we can use them to improve cutting tools like knives and drill bits, make ball bearings that are more wear and corrosion resistant, and impart heat resistance to electronic devices.”

Laine and his colleagues discovered the process while trying to upgrade fuels. “We actually were trying to break carbon-nitrogen bonds. They have many chemical similarities to the bonds we’re now trying to make,” Laine notes.

which sent radio signals back to a monitor, helping the bad guys keep tabs on their nemesis.

The judge, Jack L. Love of Albuquerque, thought such a device could provide a way to keep many non-violent offenders under close supervision, but out of prison. Love's idea—a form of high-tech house arrest—is now a real product. Electronic ankle bracelets monitor dozens of offenders each year in at least 11 locations in Colorado,

Florida, Illinois, Oregon, Pennsylvania, and British Columbia.

In most cases, eligible traffic offenders choose the bracelets over a short jail term. Rather than spending up to a year behind bars, they are put on probation and spend 30 to 90 days on "house arrest." They must go to their jobs during the day and remain in their homes at night.

Each of them wears a three-ounce ankle bracelet that

sends radio signals every 35 seconds to a nearby briefcase-sized box. The box, which is attached to the phone, transmits the signals over the line to a computer in the probation program's office. If the probationer wanders very far or removes the bracelet, the box won't pick up the signals, and the computer will notify the probation officer that something is amiss.

The bracelet program costs about \$14 to \$16 a day, including equipment and per-

sonnel. Almost all offenders who wear bracelets pay from \$7 to \$12 a day to help defray costs, but the courts must make provisions for indigents. By contrast, intensive probation costs \$5 to \$7 a day and prison costs \$35 to \$45 a day.

The devices are "transforming the future of corrections," says Dick Jorandby, public defender in Florida's Palm Beach County, the site of the first pilot project to test their effectiveness. "Anytime

MINITRENDS



He expects that within five years the materials resulting from the process will see commercial applications as adhesives and binders for other high-performance ceramics.

DOMESDAY DEVICE:

In 1086, William the Conqueror ordered a massive survey of his island kingdom. The resulting document, the Domesday Book, is England's oldest public record.

Using computers instead of quill pens, medievalists at the University of California at Santa Barbara (UCSB) are now re-recording the more than 3 million pieces of information in this remarkable document. In time for the Domesday Book's 900th birthday, the researchers have all but completed a computer

data base. The data base will make possible the first sophisticated analysis of the medieval world's most comprehensive economic and social census.

William the Conqueror ordered the Domesday Book to discover the nature and worth of the land he acquired following the Battle of Hastings in 1066. Domesday, pronounced "doomsday," was so named because the inquiry was likened to the Day of Judgment. It was used over the centuries to settle land disputes and is occasionally used even today. Not until the nineteenth century was a more detailed land survey conducted.

According to UCSB medievalist Robin Fleming, "The data base will allow people to

see the whole picture, to investigate more easily and accurately the wealth, power, class structure, political geography, and natural resources of England both before and after the Norman Conquest." The data base, scheduled to be completed in June 1987, will enable scholars to use a personal computer to analyze the Domesday data—from the number of eels on a certain manor to the total value of holdings that Norman nobility had.

HOUSE CALLS:

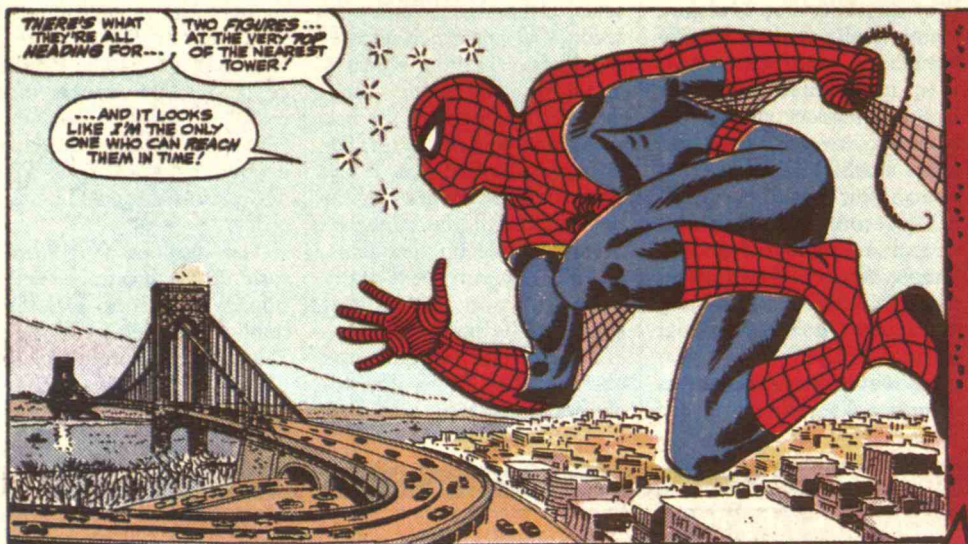
As improvements in technology make medical diagnostic tests less expensive, more accurate, and easier to perform, testing shifts from the laboratory to the doctor's office. Now testing is shifting from the doctor's office to the home. Recent surveys of health-care professionals by Market Technology Group, Inc., suggest that consumers are increasingly receptive to the idea of home diagnosis.

One survey, which looked at 150 pharmacies, indicates that they all stock some kind of home diagnostic test. More than half of the pharmacies

have or plan to open a special section devoted to home tests. The most frequently stocked items help diabetics monitor their condition. Home pregnancy tests, blood-pressure monitors, and occult blood tests are also widely available. The home pregnancy tests are the most popular.

Out of 400 physicians surveyed, most strongly approved of home diagnostic tests for diabetics. These tests have long been available, but the newer ones are much more accurate. The doctors were neutral on home pregnancy tests, and they opposed home testing for breast cancer, venereal disease, or urinary-tract infections. The survey did not reveal why doctors approved of or opposed different types of tests.

Physicians' opinions are crucial to sales, since close to two-thirds of the customers for these tests act on the advice of their doctor. On the other hand, consumers may take more initiative in the future. Home diagnostic tests are increasingly advertised both in the general media and in publications aimed at specific audiences such as the elderly.



we can find an alternative to incarceration, we win."

Since the pilot program began in 1984, about 190 Palm Beach County offenders have worn ankle bracelets. Probations have been violated in only about five or six instances, far less than usual. On the other hand, only low-risk offenders are eligible for the program. Most are convicted of driving with a suspended license or while intoxicated, according to Fred Rasmussen, executive director of Pride, Inc. His company manufactures the bracelets and, under contract to the court, oversees the pilot program. Rasmussen adds, however, that "nobody goes on this program unless they were headed for jail otherwise."

Another Florida program uses the bracelets on non-violent inmates at state prisons who are eligible for work release. Without the ankle bracelets, inmates on work-release return to the prison each night. Thanks to the ankle bracelets, after their day of work, they return to their homes.

Ironically, advocates of al-

ternatives to prison are skeptical about the devices. "In some cases, they may provide a real alternative," says Malcolm Young, director of The Sentencing Project in Washington, D.C. "But I suspect that electronic supervision is really a means of augmenting probation sentences for people who probably would have been put on probation anyway. Nobody has proven that these [bracelets] are used to keep people out of prison."

Critics like Young also worry that the program does not provide the personal counseling that is needed to help probationers alter destructive habits such as excessive drinking. No studies have been done yet to determine if offenders' lifestyles improve after the bracelets come off.

For that reason, it's difficult to assess the impact the ankle bracelets are having on sentencing, rehabilitation, and corrections policy. But already proponents envision additional applications.

Love, now a practicing attorney, imagines using the devices to confine violent inmates within state prisons

to one area. Or, he says, nursing homes could use them to keep senile nursing home residents from wandering into the streets.

Offenders' Rights

The American Civil Liberties Union (ACLU) is concerned that without uniform federal guidelines to protect offenders' rights, the bracelets will eventually be misused. "One judge might decide it would be good for people released on bail, just because he guesses they might be dangerous," notes Ari Korpivaara, a spokesperson at ACLU headquarters in New York. "You could wind up with different judges in different localities making their own decisions about the bracelets' use."

Korpivaara also believes that once electronic bracelets are accepted, more surveillance may not be far behind. "It opens the door for allowing TV cameras and listening devices to monitor probationers in their homes," he says. "We'd like to see standards in place that would prevent that."—Dee Reid

Muddy Danube?

On February 8 of this year, 100 Hungarian and Austrian environmentalists tried to march around the Margaret Island in the middle of Budapest. Their slogan was "Our drinking water and the Danube dams." In an event more familiar to Americans or Western Europeans, these marchers were protesting the damage they say will result from one of post-war Europe's most ambitious inland waterway projects, the Gabčíkovo-Nagymaros hydro-electric system.

The project is a joint venture of the Hungarian and Czechoslovakian governments, funded largely by a consortium of Austrian banks. It includes two hydro-electric stations—one at Gabčíkovo in Czechoslovakia will produce 700 megawatts, the other in Hungary at Nagymaros, 35 miles north of Budapest, will produce 140 megawatts. The project also includes two dams and a reservoir of about 20 square miles, and it requires diverting the Danube between Nagymaros and Budapest.

In early 1983, the officially sponsored Hungarian National Council for Nature and Environmental Protection alerted the government that nobody had seriously examined the potential environmental effects of the project. In response, Janos Vargha, a Budapest biologist, founded an unofficial organization called the Danube Circle. The report drawn up by Vargha's group is alarming.

Where the Danube is to be diverted, no plan exists to clear the basin of the old

route. According to the Danube Circle, tons of mud and silt will stagnate there and permeate the gravel beneath. As a result, about 25 million cubic yards of Hungary's drinking water held in underground reservoirs will be polluted. Vargha further maintains that the new canal for the Danube would cause the groundwater level to sink up to 15 feet, affecting arable and forest land in Hungary to the south.

The large industrial town of Gyor is between the two planned power stations, and the height of the water there would fluctuate up to five feet daily if the main dams were built. This will cause three major tributaries to the Danube near Gyor to dam up, thus interfering with the dispersal of Gyor's sewage. This, in turn, will threaten the water supplies of about 200 villages.

The Gabcikovo-Nagymaros project was first discussed in the mid-fifties, when Hungary and Czechoslovakia were looking for new energy sources. A detailed proposal for constructing dams and hydro-electric plants along the Danube was drawn up, but it was shelved in 1963 because of the enormous cost.

Ten years later the Czechs quietly revived the idea, and the two governments enshrined it in a 1977 treaty. Since then the Czechs have channeled considerable resources into the project. Progress on the Hungarian side has been erratic, however; until recently, officials there continued to worry about the cost.

The Hungarian government is also noticeably less repressive than the Czech one. Although the Communist Party in Budapest watches its small group of dissidents closely, it was liberal with the

Danube Circle, which insists it is not part of the political opposition. The group sees itself as a loose association concerned only with protecting north Hungary's environment from one threat.

In contrast, the Czech government tolerates no controversy over the project. All press references to the project have been uncritical, so it is difficult to know how diverting the Danube will affect Czechoslovakia. It seems likely that the natural irrigation of about 10 square miles of arable land will be severely disrupted. But the flow of tributaries will stay the same, and drinking-water systems will not be harmed.

Last year the influence of the Danube Circle grew rapidly. Members circulated a petition, signed by 80,000 people, condemning Hungarian participation in the Gabcikovo-Nagymaros project. Remarkably, state officials, workers, leading artists, and, above all, members of the science community lent their names, even though the petition had no official blessing.

For a few months, the dissent seemed to suit the Hungarian government, which pleaded with the Czechs that public sentiment tied its hands. In 1984, when fore-

casts showed that completing the project would cost \$950 million, the Budapest government stopped work on Gabcikovo-Nagymaros.

As of February 1985, not only was the construction on the Gabcikovo-Nagymaros system halted, but across the border in Austria massive popular protest had forced officials to scrap a similar hydro-electric project at Hainburg. This embarrassed the Austrian government and was a commercial disaster for the Danube Power Station Corp., which builds most Austrian generators on the Danube.

After construction had come to a halt on both the Austrian and the Gabcikovo-Nagymaros hydro-electric projects, a consortium of Austrian banks negotiated with the Hungarian government. In late 1985, they granted the Hungarians sufficient credit to finance construction of the Nagymaros dam near Budapest. Over half of the credit is to be paid back in electricity. This means that Hungary will be left with only 40 percent of the power generated by its own dam.

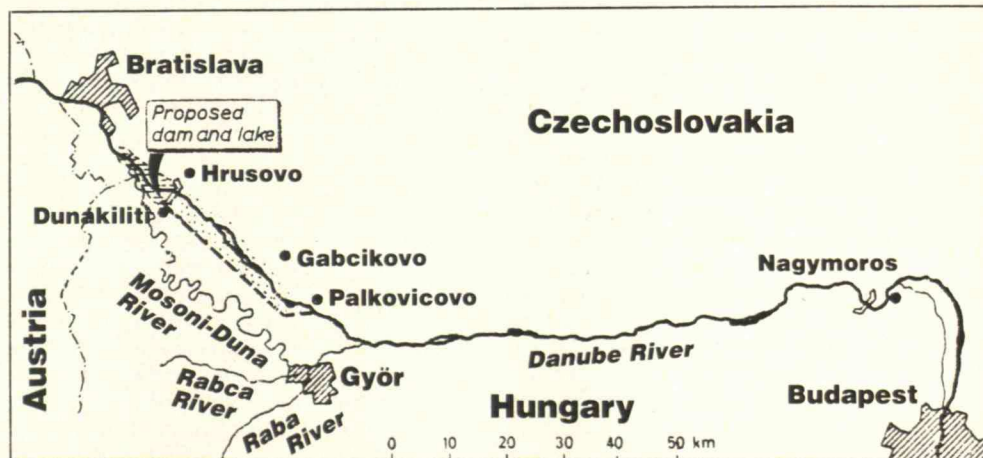
Based on the agreement with the consortium, the Hungarian government contracted with the Danube Power Station Corp. to build

the Nagymaros dam. The result is especially favorable for Austria. The Hainburg environment remains protected, yet Austria receives a new electric supply, plus an excellent commercial deal and loan repayments.

Now that Hungary has signed the deal with Austria, it appears unwilling to tolerate the Danube Circle's protests. Until two days before the walk at the Margaret Island, organizers expected a thousand Hungarians to join in. But then the police let it be known that marchers would probably lose their jobs.

When the walk occurred, police asked participants for their papers. And two hundred yards into the walk to Margaret Island, police dispersed them and arrested one Austrian citizen, who was held for four hours. The affair may mark the end of the Danube Circle, although the group indicates it intends to continue opposing the Gabcikovo-Nagymaros system.—
Misha Glenny

Hungarian environmentalists fear the impact of hydro-electric plants that their country and Czechoslovakia are building on the Danube.





New-fangled Cement

Cement bottle caps. Cement hi-fi equipment. Cement springs. Several English and Irish researchers are deriving new strength and versatility from an old-fashioned construction material, the glue that holds concrete together.

Why the interest in cement? Compared to metals and plastics, it is inexpensive. Making the dry powder takes less energy than making plastics or metals and requires cheap, plentiful raw materials—chalk and clay. Blending in a bit of water creates a moldable paste that hardens at normal temperatures, and the final product is an incombustible solid that a three-ton truck won't crush. Cement structures the Romans made still stand after 2,000 years.

Cement does have drawbacks. Bend a piece and it breaks like dry spaghetti. Drop something on it and it cracks. But abalone shells, also made of chalk, are stiffer than aluminum, as tough as Plexiglas, and 10 times more

resilient than cement.

Facts like these inspired J.D. Birchall and his colleagues at Imperial Chemical Industries (ICI) in Runcorn, England, to take another look at cement. They found its Achilles' heel: millimeter-long holes. Because of those "big" holes, cement lacks resilience, so cement bridges and beams must be reinforced with steel. Abalone shells have no such holes. Their crystals are orderly and tightly packed.

ICI researchers discovered that they could copy the structure of abalone crystals by kneading unhardened cement to remove troublesome air bubbles. They add a water-soluble organic polymer that causes the cement particles to slide easily over one another, melding together. As the polymer dries, it pulls the grains in even more closely.

This new "macro-defect-free" (MDF) cement has holes no more than a hundredth of a millimeter long. Since its resilience is 30 times that of ordinary cement, a spring made of it can tolerate 300 pounds of tension. The cement is also tough: a conventional lathe

can turn a block of it into a tube without cracking it. And when reinforced with nylon fibers, MDF cement can take over 1,000 times as much impact as ordinary cement.

Load-bearing floors, ceilings, and partitions of MDF cement would be strong and soundproof. Pipes and containers would be resistant to solvents, acids, and alkalis. Freezing and thawing would not harm them, either, because at very low temperatures MDF cement becomes stronger but not more brittle. It fails to hold up well outdoors or in water, however: either the polymer leaches out or the solid goes soft.

MDF cement's unusual combination of properties suggests unusual uses. Its strength, stiffness, and good acoustic damping make it ideal for turntables, loudspeaker cabinets, and other hi-fi components. Aesthetics are no problem: the new cement, which is as smooth as ceramic tableware, can be pigmented and glazed.

At Ulster Polytechnic in Belfast, Northern Ireland, Tom Gardiner and other scientists reinforce cement with a fabric woven of polypropylene. Adding fibers to cement impedes the growth of cracks, increases flexibility, and helps hold the solid together. Asbestos fibers work well, but asbestos is a health hazard when loose in the air. Glass fibers are good, but they corrode quickly in the alkaline environment of set cement.

To make polypropylene-reinforced cement (PRC), which entails no such disadvantages, Gardiner's group coats successive layers of the woven polymer with millimeter-thick layers of cement. The polypropylene fabric is unaffected by the alkaline cement, and the resultant material is not only strong and flexible

but weather-resistant: the freezing and thawing of a Northern Ireland winter hasn't weakened samples left on the laboratory's roof. Moreover, fabric is easier to handle in production than loose fibers, and by changing the number of layers or the tightness of the polymer weave, engineers can tailor PRC to specific applications.

Working with several industries, including the Dundee textile firm of William Halley and Sons, the Belfast researchers made PRC flagstones that can withstand a three-ton load, even though they are less than half as thick and a third as heavy as natural flagstones. The researchers also built a small house—entirely of PRC and steel bolts.—Nancy W. Stauffer

Southern Discomfort

Some days visibility in Cubatão is only a few hundred feet. Located in the heart of the southeastern Brazil industrial belt, the factories and steel mills of Cubatão emit over 1,000 tons of sulfur dioxide, nitrogen dioxide, dust, and hydrocarbons daily. The result is that Brazil's environment may face a threat more familiar to developed nations: acid pollution.

Smelting facilities are the culprits in Zambia in southern Africa, where copper and zinc bring in badly needed foreign exchange. A 1983 report by the Zambia National Conservation Strategy said sulphuric compounds released from the smelters harm vegetation downwind.

Another country troubled by acid pollution is China, the world's third-largest producer of sulfur dioxide—after

Acid pollution may cause problems in Third World industrial centers such as Cubatao, Brazil.

the United States and the Soviet Union. And pollutants from China's northeast are causing concern in Tokyo. Japanese officials believe prevailing winds carry tons of sulfur dioxide across the East China Sea each year, damaging some of their nation's most important rice and fish-producing areas.

A generation ago, even the developed world barely knew about acid pollution. No one talked about acid rain, which is formed when sulfur compounds combine with water in the atmosphere. Now countries like India, Mexico, China, and Nigeria face a bewildering Pandora's box of environmental dangers, dangers exacerbated by poverty, overpopulation, and, in most cases, staggering international debts. Yet acid pollution may prove to be deadlier in these nations than it is in more industrialized nations.

"For most developing countries, industrial development is the priority. Pollution is not a burning environmental issue," says John McCormick, an analyst for the London-based environmental group Earthscan. But, McCormick warns, environmental problems may soon be too obvious to ignore, especially in countries where growing industrial capacity coexists with largely agrarian economies.

India, which burns tons of fossil fuels to produce fertilizer, already reports damage in the Uttar Pradesh state, where fruit and grain are produced. A study by D.N. Rao of Banaras Hindu University found that sulfur emissions could diminish agricultural production across the nation 17 to 30 percent by the end of the century.

The need to measure the immediate extent of acid pollution compounds the di-

lemma of balancing environmental and economic concerns. Moreover, many countries do not yet keep track of the impact of gradual changes. Since 1983 the United Nations Environmental Program (UNEP) has coordinated regional monitoring of acid rainfall. But UNEP's funding is insufficient to produce even preliminary findings reliable enough to release. "We believe there is enough evidence to conclude that the problem seems to be expanding in a number of developing countries," says Michael Gwynne, who directs UNEP's Global Environmental Monitoring System in Nairobi. "But we have not been able to measure the long-range effects. Thirty miles away from the emission centers, we just do not have data."

However, a virgin jungle or savannah 30 miles away may be the site of the most serious damage. "Tropical soils are much more prone to the effects of pollution or acidification," notes Earthscan's McCormick. "In terms of the

soil's chemistry, northern soils seem to be much more capable of neutralizing, or buffering, the acids." The layer of topsoil is usually much thinner in the tropics, and plant roots are shorter. Further, dead leaves more readily combine with water to decompose into chemical nutrients. So chemical pollutants in the water might recycle into plant roots faster.

Different tropical systems also pose different environmental problems. In rain forests, the soil has more acid naturally, and frequent precipitation may wash away pollutants. Thus, the damage from industrial pollution may be less. In dry tropics, on the other hand, acid pollution may build up cumulatively, as it does in the Arctic. Again, not enough research has been done to begin to tell what really happens.

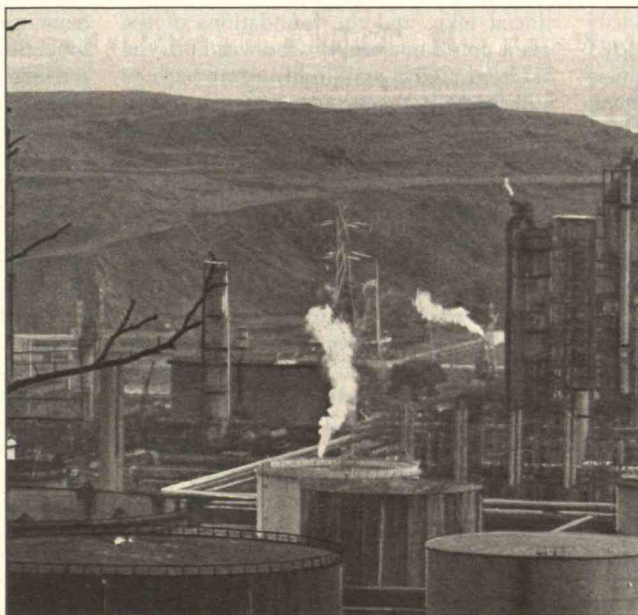
Not all the news is bad. Third World nations are beginning to take advantage of fluidized bed combustion (FBC). In this process, coal and limestone are burned together on a bed of air. Cal-

cium in the limestone bonds with sulfur in the coal, eliminating sulfur dioxide that otherwise would go into the atmosphere. Mindful of growing sulfur pollution, China is a world leader in FBC. The country has fired up more than 2,000 FBC boilers in the last ten years.

In 1984, the World Bank began issuing environmental guidelines which set acceptable levels for sulfur emissions. The bank's guidelines operate only where stricter local guidelines do not exist. Says one bank official, "Ten years ago we wouldn't even have considered guidelines, because there wouldn't have been any way to meet them. That was the case even in the developed world."

Change will be slow, however. Power plants last an average of 30 years, so old, "dirty" facilities will generate much of the Third World's power into the next century. And while 21 nations signed a U.N.-sponsored agreement to reduce sulfur emissions by 30 percent by the 1990s, none of the signatories are developing nations. "How seriously the developing world takes the problem will depend on the country," McCormick notes. "You can see all the elements coming together, but there's a lack of hard data."

Fortunately, the needed studies are beginning to be done. This April, the International Council of Scientific Unions sponsored a meeting in Caracas to discuss acid pollution in tropical countries. Papers were presented by representatives from seven countries, including India, Venezuela, China, and Brazil. It was the first international conference for exchanging research on the threat acid pollution poses to the Third World.—Joel Millman



Keeping the Cold War Out of Chernobyl

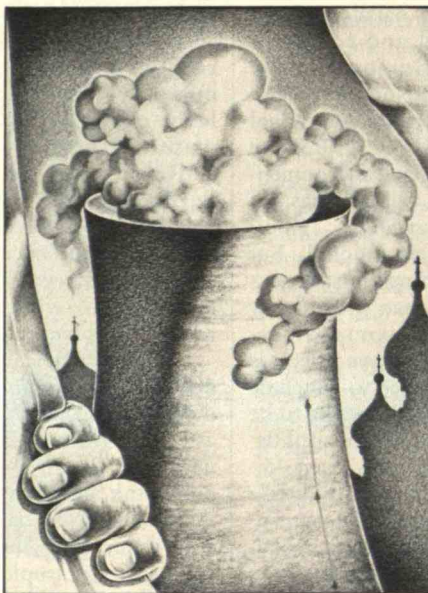
DURING the days and weeks after the Chernobyl accident, most of our attention focused on what actually happened to the reactor and to those living near the plant site. It was immediately obvious that the meltdown was the worst nuclear accident in history, and we now know it was a public-health tragedy of major proportions.

The next step is to determine what the disaster might mean for the future of the Soviet nuclear industry, the entire Soviet economy, and Soviet-U.S. relations. We might also examine just what the Soviet and U.S. governments could have done—in the immediate aftermath of the accident—to minimize the extent of damage.

Ironically, the Soviet Union's decision to emphasize nuclear energy was a belated one. Although the Soviets built the world's first nuclear generating plant in Obninsk as early as 1954, they did little more until the mid-1960s. In fact, it was only in the early 1970s that Soviet officials came to recognize the limitations of their oil and gas supplies, particularly in the "European" part of the Soviet Union (west of the Volga River). That area accounts for considerably less than half of the country's energy deposits, yet it consumed 80 percent of the nation's fuel. So Soviet leaders decided that all newly built electrical generating plants there would be nuclear powered.

The initial goals were very ambitious. At one point, the Soviets announced that their country's nuclear energy capacity would reach 40,000 megawatts in 1985 and 100,000 megawatts by 1990. Achieving those goals would have meant that nuclear power would have comprised about 15 percent of all electrical energy in 1985, and as much as 25 percent in 1990. Unfortunately, Soviet construction fell considerably below the plan. Capacity reached only 28,000 megawatts in 1985, and the 1990 goal was accordingly reduced to 70,000 megawatts.

The primary culprit was construction problems at Atomash, a \$4 billion factory in which eight 1,000-megawatt re-



*Just
as the Soviets
must be more open,
so we in the West
must not gloat.*

actors were to be built each year. Atomash was built too close to an artificial lake, and the foundations of the plant could not support the weight of the reactors. Now stabilized, Atomash is still far behind schedule, and as a result, nuclear energy constituted only 11 percent of all of the electricity the Soviet Union produced in 1985.

From the beginning of their nuclear energy program, the Soviets paid remarkably little attention to safety. Publicly, at least, official representatives of the Soviet scientific community mocked the American obsession with safety issues. Anatoly Alexandrov, president of the Soviet Academy of Sciences, had this to say about the partial meltdown at Three Mile Island in 1979: "The fuss over the construction of nuclear energy plants in the United States has nothing to do with safety. The real reason is that the development of large nuclear power stations could endanger the profits of the fuel-producing monopolies."

The chief spokesman for Soviet science

went on to assert that in contrast to Western practice, Soviet nuclear facilities "can be built in the middle of residential areas because they are absolutely safe." That explains why the Soviets have indeed built nuclear facilities within eight miles of cities such as Gorky, Voronezh, Odessa, Kharkov, and Bilibinsk. These plants were designed to provide both electricity and steam for district heating systems. They had to be close to the city centers so that the steam could be distributed without serious losses. As recently as September 1984 Peter Neporozhny, then minister of electrification, claimed that "such stations are economical and can be built in the immediate vicinity of the city because they do not emit smoke and are totally safe."

That same smugness led Soviet authorities to design their nuclear power stations without leakproof containment vessels. The Soviets did not decide to include these vessels until 1979, after the Three Mile Island accident. The world is now aware that the four operating reactors at Chernobyl were built before this decision was made.

The disaster at Chernobyl will undoubtedly alter the Soviets' attitude toward nuclear safety. Already the Soviet leadership has begun punishing local Communist Party members responsible for the belated evacuation of Chernobyl. Of course, the lack of prompt efforts to stem the accident probably had as much to do with Soviet officials' tendency to wait for guidance from above. Fearful of going out on a limb, Soviet bureaucrats are notorious for passing the buck. It remains to be seen whether the top Soviet leadership will learn anything from the disaster and encourage more independent thinking by lower-ranking officials.

However, the Soviets will probably close down all the reactors with cores that use graphite to moderate the temperature of the energy-producing uranium rods—at least temporarily. Graphite-moderated reactors were in use at Chernobyl, and officials may want to reexamine the safety of similar reactors elsewhere.

The Soviets will probably continue to build nuclear facilities, but construction may be limited to pressurized-water reactors. Such reactors use water to moderate the temperature of the rods and to cool down the core if there is an accident. They seem somewhat more akin to the commercial reactors used in the West,



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which many observers believe have a better safety record.

Furthermore, the Soviets may not be as insistent on building only nuclear plants west of the Volga. They will probably build more conventional fossil-fuel generating plants there. This should not affect the Soviets' ability to export petroleum, which is their major hard export. That's because the country has been retrofitting its generating plants, which currently use oil, to burn gas and coal. In all likelihood, the new plants will also be built for gas and coal. Since the country has very large natural-gas deposits, adequate supplies should be no problem.

Until the new generating plants are on line—and that could take several years—the Soviets will probably experience electrical brownouts. The western provinces already experience frequent brownouts, and the loss of the several plants at Chernobyl—together with the closing of other nuclear plants—will undoubtedly mean more. Such brownouts will disrupt all types of industry throughout the country, inevitably hurting economic growth.

The accident at Chernobyl may also provoke another food crisis. It is not yet clear how much the Soviets must increase their food imports to replace products contaminated by radioactive fallout. However, Soviet officials are now saying that at least 20 miles of the land downwind from the Chernobyl plant may be out of production for a decade or more. To compound the problem, the Soviets will not be able to turn to Bulgaria and Rumania because those soft-currency countries have also suffered from fallout.

The Potemkin Complex

Though interest in fossil-fueled electric generation may be renewed, it is doubtful that the Soviets will dramatically alter their emphasis on nuclear energy. Even more than most Western countries, the Soviets find it hard to face up to catastrophes and react quickly. As one letter writer to a Soviet paper complained, the domestic press will provide detailed reports about earthquakes and volcanoes in Latin America and say little, if anything, about an earthquake in nearby Tadzhikistan.

As the world knows, the Soviets did not release the news about Chernobyl for three days. That was a full day after Swedish officials, noting unusually high radioactiv-

ity in their country, pressed the Soviets for an explanation. Even then the Soviet press put the accident into a peculiar context. On Monday, April 28, the TASS dispatch began, "The accident at the Chernobyl atomic power station is the first one in the Soviet Union." Its next dispatch a day later read, "The disaster was the first one at a Soviet nuclear power plant in more than 30 years." Since Soviet officials have never publicly acknowledged the previous accident, the dispatch writer can be excused for the mistake of the day before.

Such behavior is nothing new. Soviet leaders, from Catherine the Great on, have always been reluctant to admit harsh reality, preferring to build a "Potemkin Village"—a made-to-order village complete with smiling peasants. In the case of Chernobyl, modern-day Soviet leaders probably feared (and correctly so) that Western leaders would make political hay out of the incident. The Soviets didn't want to appear inept in front of foreigners as well as their own people. And they were most certainly afraid that news about such a catastrophe might spark a panic in the Soviet Union, bringing food shortages and even riots.

If anything constructive is to result from the Chernobyl incident, it is that the Soviets may finally realize that their habitual secretiveness does not suit the nuclear age. And they have begun to divulge important technical information about the accident—if not about the full impact on Soviet lives.

But just as the Soviets must be more open, so we in the West must not gloat. When the Soviets deliberately hold back information, it is sometimes difficult not to give exaggerated reports of what happened. In the case of Chernobyl, some U.S. officials did exaggerate, particularly about possible casualties from radiation exposure. This created the impression that the U.S. government was trying to capitalize on the accident. Our government would have acted much more in the American spirit if it had immediately offered medical help and food supplies to the Soviet people.

Chernobyl must not be allowed to become a Cold War issue. It is vitally important that all countries share their knowledge about nuclear and other humanmade disasters—as quickly and efficiently as possible. In today's world, no reactor is an island unto itself. □

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BY S. FREDERICK STARR

Liberal Arts Colleges Are Keeping Science Strong

UNDERGRADUATE interest in basic science has plummeted in the past two decades. Today half as many freshmen on American campuses intend to major in basic sciences as their counterparts in the late 1960s. While the problem can be traced all the way back to primary education, the undergraduate years are the last point at which large numbers of students not previously oriented toward science can be drawn into the enterprise. This trend can only erode our nation's technological and industrial base.

Despite this danger, the percentage of freshmen interested in science has held steady at the country's leading private liberal arts colleges. These schools can be thought of as "research colleges," since their professors actively conduct scientific research as well as teach. Because these schools focus exclusively on the undergraduate, they have a higher proportion of students interested in majoring in basic science than most of the country's top research universities. And these colleges have provided an increasing proportion of the nation's science graduates. Yet these institutions receive only a trivial amount of federal help for such crucial needs as research equipment and instruments.

The leading research colleges include four dozen schools identified through an Oberlin College research project that began last year. In addition to Oberlin, they include Carleton, Franklin and Marshall, Swarthmore, Mount Holyoke, Reed, Williams, and some 41 others. They are considered the nation's leading undergraduate colleges for three reasons. Among the colleges, they have the largest proportion of alumni who have gone on to earn doctorates in science. More of their students have math SAT scores above 600. And their faculty members have received the most National Science Foundation (NSF) fellowships.

Until recently, few people appreciated these schools' distinctive contribution to the nation's basic-science efforts. It was easy to assume that the strongest undergraduate programs in chemistry, geology, mathematics, physics, and the biological sciences were found at the research universities where graduate study flourishes.

However, this hasn't necessarily been the case. The rapid and sustained decline of interest in basic science has affected uni-



versities noticeably. Public universities saw their proportion of freshmen intending to major in science fall from 13 percent in 1975 to 8 percent in 1984. Private universities fared even worse, with a drop from 22 percent to 12 percent during the same period. Even the 26 most selective private universities—those with the largest percentages of students with combined SAT scores above 1,175—saw the proportion of students who planned to major in science drop from 26 percent to 17 percent.

These trends translate into a serious decline in the actual number of degrees awarded in the basic sciences. In 1983, the 20 universities with the graduate programs rated most highly by the National Academy of Sciences conferred 17 percent fewer baccalaureates in the basic sciences than in 1976. This decline occurred despite the fact that the total number of baccalaureates awarded increased slightly.

By contrast, the top liberal arts colleges have been virtually immune to these trends. From 1975 to 1984, the percentage of freshmen planning to major in science remained at between 28 and 31 percent—more than four times the national average. The same group has had a similar performance in the proportion of science baccalaureates granted, which has held at 24

percent. The number of science degrees awarded by these colleges actually rose 16 percent between 1975 and 1983, the last year for which full data are available.

How do the leading research colleges compare to all schools granting undergraduate degrees in basic science? In 1975, this group conferred 42 of every 1,000 U.S. degrees in basic science. In 1983, their share was 58.3 per 1,000.

Strong in Recruiting Women

These schools are enriching American science in other ways, too. The liberal arts colleges have been the site of an unparalleled recruitment of women into science. Fully 52 percent of basic-science majors at the top colleges are women—a figure far higher than that for public or private research universities.

The obvious explanation for the success of liberal arts colleges in science is that they focus on the undergraduate. No graduate students claim professors' time or substitute as teachers. College faculty members are expected to devote more time to teaching than their university colleagues. As a result, the classroom ratio of permanent faculty to undergraduate students is far higher at colleges than at even

S. FREDERICK STARR is president of Oberlin College.

the finest universities.

This effort affects all teaching levels. One-third to one-half of all science courses at liberal arts colleges are introductory, which helps recruit majors. Tenured faculty members who have at least six years of classroom experience and a proven commitment to undergraduate education teach half these introductory courses.

Top undergraduate science students receive excellent training at leading universities and colleges alike. However, undergrads are more likely to be drawn into advanced research at liberal arts colleges. And only at these schools are they likely to apprentice to professors, since no graduate students are available. Undergraduates co-authored nearly one-third of all journal articles published by liberal arts college faculty from 1980 to 1984. In contrast, undergraduates at major research universities co-author less than 1 percent of the journal articles published by these schools' faculty.

Funding for Colleges vs. Universities

Since World War II the United States has built up several hundred universities as centers for advanced research and graduate study in science. In 1982, the 100 top-funded research universities garnered 86 percent of all NSF grants for higher education, and 91 percent of all NSF grants for facilities and equipment. Some 98 percent of all federal support for academic R&D goes to universities.

We are indebted to this investment, for it has established America's global leadership in many fields. However, the top liberal arts colleges have been neglected. In spite of their small funding base, they have experienced a rapid decline in federal support. During the inflationary years of 1978 to 1982, all federal support for the four dozen leading research colleges dropped by 28 percent in real value, while their support from NSF alone plummeted 65 percent. Fewer than half the institutions in the Oberlin study received any help for facilities, teaching equipment, and instruments in 1978. None did in 1982, although the situation has improved slightly since then.

The result: top liberal arts colleges have been accomplishing far more with far less. They have sustained this remarkable record with their own resources. They have remained free not only from federal entanglements but also from corporate spon-

sors, which have overwhelmingly concentrated their giving on universities. Is this not an ideal situation?

Not necessarily. Unfortunately, the picture has a darker side. To paraphrase Voltaire, the colleges have been living off the capital of another era. None can compete successfully with even minor universities for equipment, laboratory start-up funds, and summer research stipends for young scientists. College-based scientists may have less time to devote to their research because of heavier teaching loads. But should they receive half the external funding that their university colleagues get?

College scientists' salaries are also much lower than those of their university counterparts, and these professors have less job security. There are far more endowment dollars per student at major private universities than at leading colleges, and the gap is widening. So the scientific enterprise on college campuses increasingly depends on tuition payments—at a time when the supply of potential applicants, and hence enrollees, will soon decline.

The Wish List

Liberal arts colleges have no interest in weakening support for science at leading universities. Both types of institutions are linked in a common enterprise, and benefit each other in many ways. What we need is not a wholesale shift in funding but an adjustment of emphasis that would benefit undergraduate science everywhere.

What would this shift involve?

The NSF should support undergraduate science on college campuses in the same way that it has supported graduate education at leading universities. It should define the top colleges solely on the basis of student and faculty performance and the schools' financial commitment, not by general notions of prestige. Institutions included in this group would change from time to time.

After identifying the major research colleges, the NSF should recruit scientists from these schools for the foundation's various boards, councils, and panels, beginning with the National Science Board. Few scientists from the top colleges are on this board now, and relatively few are members of the NSF's other groups. Likewise, senior university scientists should be members of the NSF groups that deal with undergraduate science.

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the NSF could offer would be substantial, one-time grants to underwrite science professorships at leading undergraduate campuses. The National Endowment for the Humanities has such a program, which requires recipient institutions to match government grants twofold. The NSF should also consider offering large one-time matching grants for major instructional equipment.

The NSF should significantly strengthen its existing aid programs for undergraduate science and equipment, and establish a special fund for the top colleges. This fund could be used to provide one-time grants for laboratory start-up costs and summer stipends for junior faculty.

The NSF should also restore the Faculty Professional Development Program, which funded research leaves and brought great benefits to college scientists before it was dropped in 1982. Some college professors might be granted leaves to work on major NSF-sponsored projects at universities and national research centers. The foundation could award bonuses to institutions that include college scientists.

Long ago the NSF established the principle of supporting universities of proven quality. Given the increasingly important role that liberal arts colleges play in training scientists, the NSF should also include these schools in this effort. □

How Not to Promote Technology Transfer

FEDERAL contractors have often begrudged the time needed to prepare the detailed, mandatory reports about the products and processes they have developed while working for the government. The government requires the contractors to elaborate on a number of fine points in these reports, from the problems they were working on to a list of everyone involved in the work. Painful as this task may be, however, it has led to the commercialization of thousands of technological spin-offs—from pacemaker batteries to lightweight golf clubs—because many of the reports have been made widely available. But federal policy changes in the 1980s have loosened, and in many cases eliminated, contractors' reporting requirements for new technology. In so doing, we have exchanged the future health of our nation's industry for an easier workday for federal contractors.

The government made this error when it reversed a longstanding policy of claiming the first rights to all patents resulting from federally funded R&D work. The government decided to give contractors the first rights to these patents in hopes that they will do a better job of commercializing their inventions than federal agencies. In 1980 Congress changed the rules for universities, nonprofit organizations, and small businesses. In 1983, a presidential memorandum extended the new rules to all government contractors.

These changes have considerable merit in cases where contractors are interested in commercializing their advances. But unfortunately, the government also canceled the requirement that contractors file reports about improvements that are not unique enough to be patented. Contractors can now also take up to three years to report their patentable advances—before they had to report patentable items within six months. The goal of these changes is to standardize reporting among government agencies, since contractors had complained for 15 years about the different forms they had to complete.

N.J. GOLDSTONE is a technical consultant and executive secretary of the Technology Transfer Society, based in Beverly Hills, Calif. He worked for Rockwell International for 25 years, managing its technology-transfer operation for the Apollo and space shuttle contracts from 1970 to 1981.



In 1980, Adm. Hyman G. Rickover warned that the bill incorporating these changes "would achieve exactly the opposite of what it purports. It would impede, not enhance, the development and dissemination of technology. It would hurt small business. It would inhibit competition [and] would be costly to taxpayers."

These effects have been particularly noticeable with NASA's Technology Utilization Program, one of the government's

American business will be hurt because government contractors need no longer report all major advances.

most successful technology-transfer efforts. The program was created in response to the 1958 Space Act, which called for the government to "provide for the widest practicable and appropriate dissemination" of technology created under NASA

contracts. NASA required all contractors to report promptly any patentable inventions and significant advances that resulted from federally financed research. Those who didn't file could be hit with up

to \$50,000 in penalties. While penalties were rarely used, they were effective, and between 1964 and 1984 contractors submitted almost 37,000 reports. NASA published 30 to 40 percent of the most valuable, many in its quarterly *Tech Briefs*, which has 70,000 U.S. subscribers. The program also received 1.75 million inquiries for more details about reported advances from 1964 to 1984.

Most of the reports have described non-patentable advances. Thousands of companies have used this information to improve their manufacturing processes, introduce products, and incorporate new computer programs into their operations. The reports have sparked commercial spin-offs in virtually every sector of the economy, including solar collectors, machinery to cut grooves into highways to improve traction, and improved contamination controls for making electronic components.

The new policies have already significantly affected this flow of information. Contractors submitted 600 fewer reports to NASA between 1981 and 1983 than from 1979 to 1981, according to the Denver Research Institute. That 24 percent drop occurred *before* the policy changes were extended to include large contractors. The full effects of the new policies won't be known for a number of years since commercializing R&D advances can take up to 15 years.

The less stringent reporting requirements allow contractors to use the technology they develop as trade secrets. While these trade secrets give individual contractors an edge in competition, they hurt American industry in general. And a new process benefits no one if the contractor that develops it does not bother to use it. Moreover, the government may hurt itself by allowing advances to go unreported. For example, if a contractor develops an improved welding process but does not report it, other firms cannot improve the welding jobs they do for the government.

The change that lets contractors delay reporting patentable advances for three years is actually preventing some patents from being filed. At NASA's Jet Propulsion Laboratory in Pasadena, Calif., for example, employees and contractors filed 30 patent applications in 1984 compared with 70 in 1980, when they could apply for patents only by petitioning the government for a waiver.

Why should the number of patent applications drop? Large contractors may decide that certain advances fall outside their commercial interests or do not have enough market potential. A patented item's market must approach \$50 million to \$100 million annually to interest a large aerospace company, for example.

However, smaller companies might be very interested in commercializing an advance with a more limited market potential. They should be able to, since the government may patent and license any technological advance contractors aren't interested in. However, the U.S. Patent and Trademark Office requires patent applications to be filed promptly—normally within a year of an item's identification. So the three-year reporting delay could prevent the government from applying for patents that contractors don't pursue.

Of course, even if no one has applied for a patent, a new product or process is still available to everyone if it has been reported and published. But a company is much more apt to spend money to develop a commercial application for a process patented by the government, which can restrict the number of licenses it grants. Under the new system, a company has an unknown number of competitors interested in commercializing an unpatented advance.

It should be pointed out that the number of patents filed by employees and contractors of three agencies—the National Science Foundation, the Department of Agriculture, and the Department of Health and Human Services—did increase in the early 1980s. NSF employees and contractors filed for 150 patents in 1983 compared with 110 in 1982—a 36 percent increase. At least part of this trend may result from the more aggressive pursuit of patents by universities, which conduct a significant percentage of this R&D work. However, the number of patent applications filed by contractors of these organizations is very small compared with the number filed by those of NASA and the Department of Defense.

While federal contractors should be able to obtain patents for their advances, NASA and all other federal agencies must again require researchers to report all significant new products and processes. And the three-year period now permitted for reporting patentable advances must be shortened to six months again. □



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tions that neither increase the real wealth of the nation nor improve its citizens' quality of life.

We do need to develop participatory management, but we can do so only in organizations that are sufficiently small or nonbureaucratic to allow the necessary two-way communication. We are beginning to see industry and environmentalists cooperating on some environmental problems, bypassing lawmakers. This is a good sign. But what I remember best is that my specialty-chemicals plant employed about 400 people and was successful—and that it closed its doors as a unit of a conglomerate employing 160,000.

WINSLOW H. HARTFORD
Charlotte, N.C.

HUMAN VS. SILICON EXPERTISE

In "Why Computers May Never Think Like People" (*January*, page 42), Hubert and Stuart Dreyfus conveniently ignore MYCIN, an expert system used to diagnose

patients with serious infections and suggest appropriate antibiotics. In one study of this system, evaluators were not told which recommendations were MYCIN's and which came from human physicians. MYCIN's recommendations were judged better than, or equal to, those of five experts in infectious disease.

Another system, AQ11, was used to develop diagnosis rules for 15 soybean diseases. Knowledge engineers also developed rules by consulting with plant pathologists. A test using 340 diseased plants revealed that the computer-generated rules yielded the correct diagnosis 97.6 percent of the time, while the expert-derived rules were right 71.8 percent of the time. The AQ11 rules also gave fewer alternative diagnoses.

The question is not whether artificial-intelligence programs will ever think like humans, but whether humans will ever think as well as artificial-intelligence programs do.

RICHARD GRIGONIS
Harrison, N.J.

The Dreyfus brothers overlook the fact that practical, working expert systems often have little if anything to do with what many people call artificial intelligence (AI). Though those who design expert systems study the AI literature, it doesn't usually help much. Some cynics have come to the conclusion that "if it works, it isn't AI."

Also, there are at least two different kinds of expert systems. One operates on a finite and unchanging set of rules to achieve a simply defined objective—for example, playing the perfect game of tic-tac-toe. The other kind operates on a changeable set of rules to achieve an objective that is often less simply defined—for example, diagnosing illnesses. A human operator interacts with this second kind of expert system.

KENNETH H. NORWICH
Toronto, Canada

AIDING U.S. INDUSTRY

In "A World-Class Economy: Getting Back into the Ring" (*August/September*, page 27), Lester Thurow seems to be dealing with theory instead of reality. The Harley-Davidson case does not prove that U.S. economic policies are faulty. Rather, it shows the need for the government to help industries when they are under attack

by foreign competitors. Harley has also shown how a company can work within current trade laws to strengthen its position and, in fact, regain market share.

I agree with Thurow that unless U.S. companies can meet or beat the productivity of foreign competitors, they have no future. But I believe this country should ensure that its industries have a fair environment in which to compete.

VAUGHN L. BEALS
Milwaukee, Wis.

Vaughn L. Beals is chairman and chief executive officer of Harley-Davidson Motor Co.

Thurow's ideas are a breath of fresh air amid popular talk of America's supposedly inevitable movement toward a strictly service or information economy. I agree with him that a good economy must have both service and industrial components. I would further argue that a primarily information or service economy risks becoming elitist.

MICHAEL MANOOG KAZANJIAN
Chicago, Ill.

WHALE RESEARCH

In "How Hunters Are Saving the Bowhead Whale" (*November/December*, page 82), John G. Blair does not accurately describe the North Slope Borough's studies of the bowhead whale. The investigators are not simply listening to the whales. Rather, they are detecting their sounds on a fixed array of specially equipped buoys. The sounds are transmitted by radio link to a remote location, where they are recorded. Then the sounds are analyzed to determine where the whales were when they made the sounds. The investigators can use this information to track individual whales and to estimate how many whales passed through a given area in a given period.

WILLIAM T. ELLISON
Clinton, Mass.

William T. Ellison is one of the principal investigators for the North Slope Borough's studies of the bowhead whale.

DEMAND FOR HELIUM

It is true, as John Mattill points out, that helium's unique properties mean it is irreplaceable in some uses (*"The Short and the Long of Helium," January*, page 77). *Continued on page 73*

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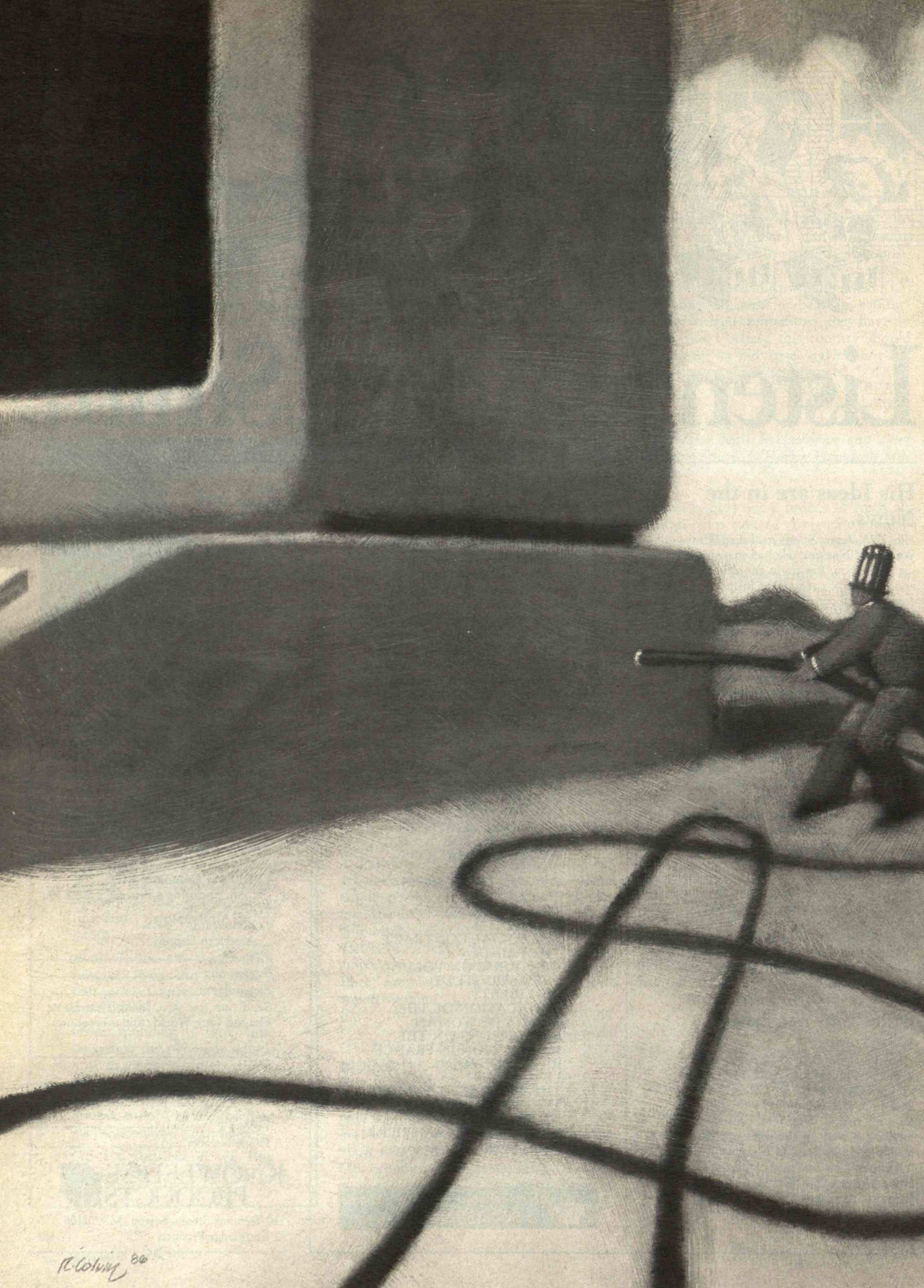
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*Tax incentives have been
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High Technology's Stake in Tax Reform

BY PHILIP WEBRE AND DAVID BODDE

HIGH-TECHNOLOGY industries are widely regarded as engines of economic growth, and they are the source of the technical capabilities that underlie the nation's defense. Accordingly, support for them has been a constant feature of federal technology policy. This support has taken two forms: grants and contracts for research and development, and tax reductions aimed at stimulating research, development, and investment in new technology.

In 1985, for example, federal agencies such as the National Science Foundation, the Department of Energy, and the Department of Defense spent over \$8 billion to develop new technology with commercial potential. A roughly comparable amount was "spent" through foregone taxes. These tax preferences benefit high technology in two ways: they reduce the cost of R&D, and they encourage capital investment by reducing taxes on capital gains and accelerating depreciation allowances.

The plans for general tax reform proposed by the White

This article was written before the Senate Finance Committee released its proposals for income tax reform. Hence the authors refer only to the earlier plans of President Reagan and the House of Representatives. As they affect high technology, the Senate proposals differ from those of the president and the House by eliminating the special treatment of capital gains and the tax advantages of R&D limited partnerships (RDLPs). On the other hand, the Senate bill would liberalize the depreciation of capital equipment. While the change affecting RDLPs makes the Senate treatment less favorable to high technology than the other reform proposals, the authors' basic conclusion remains: by improving the performance of the economy, tax reform will benefit high technology far more than the tax preferences that may be lost.

ILLUSTRATIONS: ROB COLVIN

High-tech tax preferences are designed to reduce the cost of R&D and speed the flow of innovation.

House in June 1985, and those passed by the House in December 1985 that will be blended with those of the Senate, would sharply curtail some of these tax preferences. For that reason, many high-tech industries initially opposed them. However, the tax benefits high technology may lose are not central to its success, and a thorough overhaul of the tax system would benefit high technology by improving the performance of the economy as a whole. On the other hand, even if Congress fails to enact general tax reform, tax provisions aimed at stimulating R&D need to be improved if they are to provide the intended benefits for high technology.

High Technology and Economic Progress

Whatever boundaries one uses to distinguish high technology from the rest of industry are inevitably arbitrary. Like beauty or obesity, most observers simply know it when they see it. We have chosen a conventional definition: a high-tech industry is one with a ratio of R&D spending to sales that is one-third higher than the average in all manufacturing industries; and with a ten-year growth rate in employment that is higher than the manufacturing average. According to these criteria, high-tech industries include those that produce drugs, industrial organic chemicals, office and computing machines, communications equipment, electronic components, aircraft, missiles, and instruments. Firms in these industries now account for over half of all private R&D spending in the United States, over one-third of U.S. exports, and one-sixth of the country's manufacturing output and employment. Because these firms perform so much of the nation's R&D, the tax policies that affect them are an important element of federal science and technology policy.

The success of high-technology industries is considered important to the nation for two reasons: the benefits of high-tech research extend well beyond the companies that sponsor it, and high-technology products drive technical change in many industrial sectors. In a classic study, Edwin Mansfield of the

University of Pennsylvania showed in 1971 that the total benefits from a company's R&D are roughly double the benefits to the company. Because of this, companies tend to perform less R&D than would be desirable from a national point of view, and public subsidies to increase private R&D make economic sense.

High-tech industries also receive special attention because they are considered "strategic"—that is, they stimulate technical progress across a broad range of industries. Thus they contribute more to general economic growth than is measured by the value of their own output. Railroads may have had such a role in the nineteenth century: their demand for high-quality rail and equipment stimulated the steel industry, which in turn was able to provide low-cost steel for other industries. Furthermore, the railroads' expansion into the American West (with government assistance) opened new markets for agricultural products and allowed manufactured goods to reach western markets.

Both propositions, however, are controversial. The public gains little when one firm pursues R&D that duplicates, either intentionally or unintentionally, research already undertaken by another firm. The tax code, however, cannot make such distinctions and is limited to encouraging R&D regardless of type. In addition, many economic historians have challenged the concept of strategic industries. They cite historical evidence that a flexible, technologically progressive economy is the precursor to strategic industries. These historians suggest that such a progressive economy—rather than individual industries—is the real driver of economic growth.

Lowering the Cost of Innovation

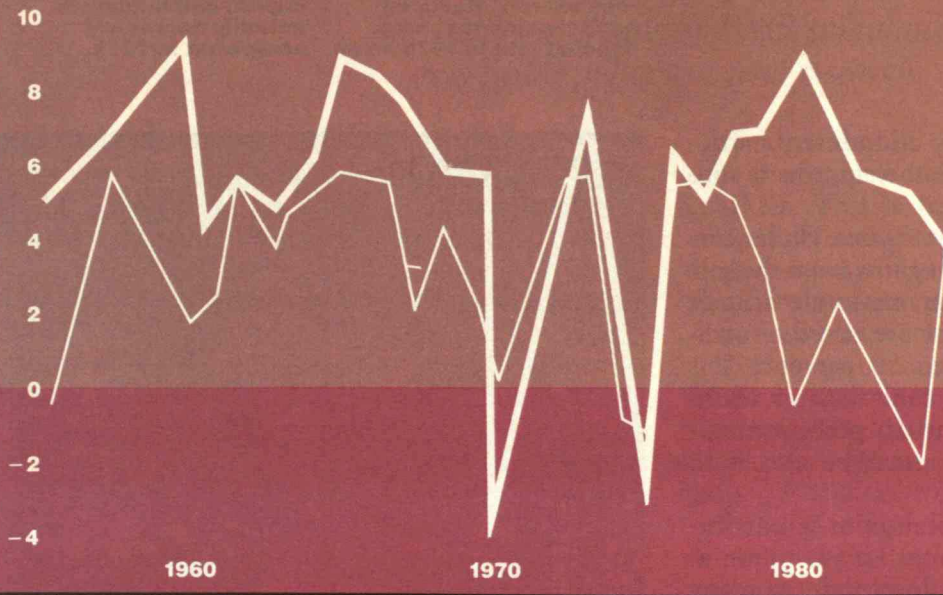
Tax-based support of high-tech industries takes two approaches: reducing the cost to private firms of R&D, and accelerating the flow of technological innovation from the laboratory into industry.

Three tax provisions aim to stimulate research by lowering its cost:

□ *Deductions for research expenses.* Companies may deduct certain costs of research—mainly direct labor and materials—from taxable income in the year the costs are incurred. This practice, termed "expensing," takes R&D out of the category of a capital investment, where costs have to be written off over many years. This stimulates R&D by mak-

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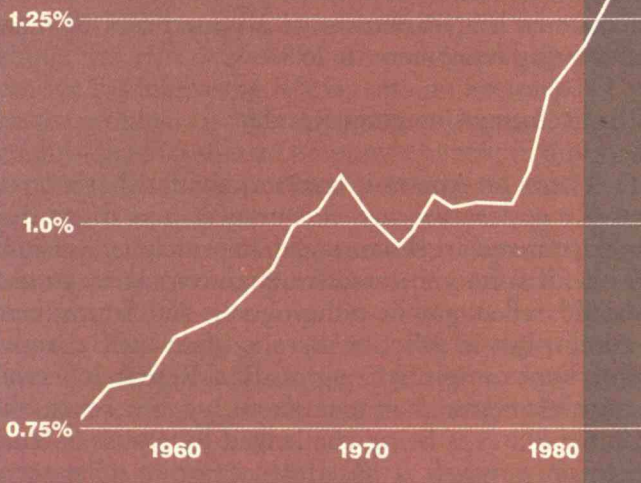
Percent change in inflation-adjusted dollars



Left: Changes in company R&D expenditures closely tracked changes in GNP until 1980, when inflation-adjusted R&D spending rose by nearly 9 percent while GNP fell 0.3 percent. This divergence was probably the result of increasing international competition and the rise of research-intensive industries, rather than the effect of the R&D tax credit.

Below: Inflation-adjusted industrial R&D expenditures rose as a percentage of GNP throughout the 1960s and much of the 1970s. The rising curve of R&D expenses, already steep, was not significantly affected by the tax credit for increases in R&D enacted in 1981.

Industrial R&D as a percent of GNP



ing it less costly than other capital investments. The congressional Joint Committee on Taxation estimates that this research deduction will reduce tax payments by roughly \$3.7 billion in fiscal-year 1986. The deduction is available to any firm that invests in R&D in any field.

□ **Tax credits for incremental research expenses.** Between 1981 and 1985, firms that increased certain research expenses—primarily wages and materials—above the previous three years' average were eligible for tax credits of 25 percent of the increase. In making the credit large but applying it only to incremental expenditures, Congress wanted to provide an incentive for firms to perform R&D that would not

have been done otherwise, and to avoid giving tax advantages to firms that did not change their behavior. The credit expired at the end of 1985, but legislation now before Congress would extend it, retroactive to January 1986. The cost to the federal government in taxes foregone was about \$1.5 billion in 1985, and the future tax credits would probably continue the cost to the government at about the same level.

□ **Limited R&D partnerships.** High-tech companies can reduce their taxes by forming R&D limited partnerships (RDLPs), which—like any partnerships—allow tax benefits to flow directly to the individual partners.

The mechanism to accomplish this begins with a legal entity called the general partner, typically created by the sponsoring company. Capital is provided to the general partner by investors known as limited partners, whose payments are deductible as R&D expenses. The general partner uses this capital to perform research, supplying the results to the sponsoring company in return for royalty payments. The limited partners share this royalty income, which is taxed as a capital gain—at a lower rate than ordinary income. Thus, a firm can perform research without using its own capital, and all investors realize the sizable tax advantages accompanying both R&D investments and capital gains.

RDLPs have been used to fund a wide variety of R&D activities, ranging from incremental improvements in computer software to radical innovations. In 1984, RDLPs accounted for between \$400 million and \$1 billion of the \$49 billion spent by industry on R&D.

Rapid expansion of worldwide demand for electronic goods stimulated the U.S. industry in the 1980s, and venture-capital funding rose sharply. Reduced capital-gains tax rates, enacted late in 1978 as an

incentive for new investment, seemed to have little effect. The growth of venture capital occurred before the taxes were reduced, and venture-capital commitments actually decreased somewhat in 1979.

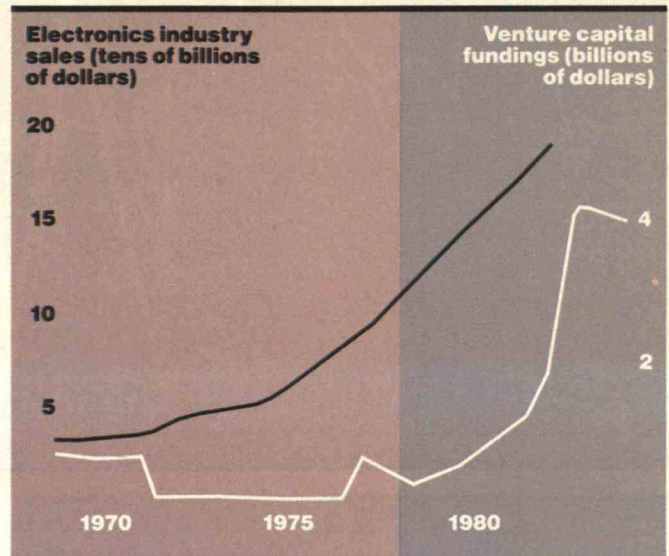
Two tax incentives enjoyed by all industry particularly help high-tech firms move their products into commercial use:

□ *Preferential treatment of capital gains.* Under current law, 60 percent of long-term gains from the sale of capital assets such as stock or real estate are not taxed. The remaining 40 percent are taxed at ordinary rates, which do not exceed 50 percent. This represents a maximum tax on capital gains of 20 percent—substantially below the 50 percent maximum tax rate on ordinary income. The idea is to encourage capital investment.

The special treatment of capital gains is particularly important to venture capital, a \$4 billion-a-year market in which investors expect to incur many small losses and realize a few extraordinary gains. High-tech companies are attractive to venture-capital investors because their need for capital is great and their growth rate can be quite high. Moreover, high-tech companies are formed at a rate that is four times the average for all industries. Thus, the tax treatment of venture capital is often linked to the economic fortunes of high-tech industries.

□ *Faster depreciation of capital investment.* The period for depreciating buildings and equipment is reduced for tax purposes under the accelerated cost recovery system (ACRS). Funds used to buy equipment are also eligible for an investment tax credit (ITC). ACRS, enacted in 1981, generally allows the cost of an asset to be depreciated faster than it actually depreciates physically or economically. This write-off makes a business appear less profitable, and so allows it to pay less taxes, early in the life of an asset in exchange for higher taxes later on. The firm therefore has more cash at a time when capital is likely to be most needed. The ITC provides a tax credit of 10 percent of the purchase price of new equipment. Together, ACRS and ITC can yield deductions that exceed the original cost of the equipment.

These tax advantages have particular importance to high-tech industries because they are higher-than-average investors in new buildings and equipment. High-technology capital investments were nearly 6 percent of sales, compared with 3.9 percent for all manufacturing industries, in 1981. Furthermore, tax advantages to all purchasers of new equipment are likely to stimulate demand for high-technology products, because such products represent about one-third of all capital goods. Indeed, computers alone



accounted for 14 percent of all purchases of manufacturing equipment in 1984.

Tax Reform: Uncertain Results

Taxes can be economic levers: activities that are relatively undertaxed are encouraged, and those that are overtaxed are discouraged. In principle, decisions on which activities receive preferential treatment should reflect public-policy goals and sound economics. But in practice there is often little correlation. For example, a Congressional Research Service study estimates that manufacturing, in which the United States is being challenged by overseas competition, is taxed at an effective rate of 45 percent while communications, in which we are dominant, are taxed at 23 percent. Widespread dissatisfaction with how the burden of taxation is balanced adds to the current pressures for tax reform.

Most economists believe that general tax reform would benefit the economy as a whole by simplifying financial management and removing artificial constraints on growth. The American Enterprise Institute, for example, suggests that reform could yield a prompt increase of about \$40 billion in annual gross national product. This stimulation of the economy would expand markets for high-tech products. But even advocates admit that the complexities of today's tax code and the lack of systematic evidence make the ultimate effects difficult to judge.

Recent reform proposals, including those of Pres-

*The \$1.5 billion allowed
in R&D tax credits in 1983 stimulated
only \$600 million in new research.*

ident Reagan in June 1985 and those passed last December by the House, share two characteristics. The maximum rate at which any income can be taxed would be reduced considerably, to 35 percent in the president's proposal and 38 percent in the House bill. But revenues would remain constant (about \$778 billion in 1986) because there would be fewer special provisions for preferred types of income.

Both proposals retain the two tax exclusions that are generally believed to be of greatest value to high-tech companies—the deduction of R&D costs and the R&D limited partnership. However, capital-depreciation schedules would be lengthened, the favorable treatment of capital gains reduced, and the investment tax credit eliminated.

The Reagan administration and Congress now seem inclined to renew the 25 percent tax credit on incremental R&D expenses that expired in December 1985. However, the fundamental questions about the effectiveness of this tax credit as an incentive for increasing R&D remain unresolved. The basic problem is the incremental nature of the credit—the fact that a company's benefit in any year depends on the difference between its R&D expenditure in that year and its average expenditure during the previous three years. This dependence on history can have unintended results. Companies with declining R&D spending, for example, receive less benefit than companies whose R&D expenditures have not dropped. Thus, the credit is weakest when industrial research is declining—exactly when it is needed most.

Another important difficulty is that new research spending in one year tends to reduce the tax incentive for new spending in later years. As a result, the tax relief often amounts to much less than 25 percent of increased R&D spending. Consider, for example, the case of a company with a history of level R&D spending that increased its research by \$100,000 in one year. It would receive a \$25,000 tax credit for that year. If the company made no further changes in its R&D spending, that would be the end of the matter. But this additional \$100,000 would raise the company's three-year average by \$33,000, so a second \$100,000 R&D increase in the next year would be rewarded by a lower tax benefit than resulted from the first increment. In effect, spending an additional dollar in any year reduces the tax incentive to spend one more dollar in the three following years.

Finally, the tax credit fails to support new high-tech companies and older companies entering new markets. This is because new firms are often unprofitable in their early years and therefore pay no taxes anyway. Also, the law prohibits established firms from claiming the tax benefit for R&D associated with movement into new markets.

For these reasons, the overall effect of the tax credit on high-tech R&D may be quite small. Preliminary data gathered by Edwin Mansfield at the University of Pennsylvania indicate that the \$1.5 billion in R&D tax credits allowed in 1983 stimulated only \$600 million in new research activity in 1983. Most of the reduced taxes seem to have supported research that would have been done anyway.

Indeed, the R&D tax credit appears unconnected to the rising curve of private R&D expenses that began in the late 1970s, well before the tax credit was enacted in 1981. On the other hand, the tax credit may have helped keep R&D spending constant in 1982 despite the recession, when R&D investments tend to fall.

This evidence is ambiguous because it is enmeshed with a larger question: Why was there a break in the early 1980s in the historical link between gross national product and R&D? These two measures tracked closely before 1980. But in that year, while GNP adjusted for inflation fell by 0.3 percent, inflation-adjusted R&D spending rose by nearly 9 percent. We speculate that the forces sustaining R&D during the 1981-82 recession were those that drove it upward in the 1970s—greater international competition and the increasing share of GNP contributed by research-intensive industries. If this is true, reducing or even eliminating the R&D tax credit would probably not jeopardize industrial R&D.

The Effect of Capital Gains on Venture Capital

Much circumstantial evidence suggests that the tax rate on capital gains has a strong effect on venture capital. After 1969, when Congress raised the maximum tax rate on capital gains from 25 to 45 percent, total venture-capital investments fell from \$171 million (1969) to \$97 million (1970). The level of investment continued to dwindle until after 1977, when the top tax rate for capital gains was reduced to 28 percent. Funds flowing to venture-capital firms then began to grow rapidly—from \$600 million in 1978 to \$4.2 billion in 1984.

General tax reform promises higher capital-gains taxes. But high-tech industry may not suffer.

But capital-gains tax policy may have had less to do with these changes than is commonly supposed. The recession of 1970, which included a 36 percent drop in the stock market, forced many investors out of capital markets. Technology stocks suffered especially, many of them losing 70 to 80 percent of their value when earnings plunged after a period of speculative excesses. In this atmosphere, new venture investment was naturally depressed.

The dramatic recovery in venture-capital investment during the late 1970s was preceded by an equally dramatic recovery for high-tech companies, especially those in electronics. As the 1974-75 recession ended, the demand for electronic goods rose worldwide. The total output of the U.S. electronics industry increased by over 60 percent between 1975 and 1978. Demand for semiconductors was so high that U.S. manufacturers could not keep up, leading to the first penetration of the U.S. market by Japanese-made computer memory chips.

Venture-capital investors responded to the demand-driven opportunities with enthusiasm even before the capital-gains tax was lowered in October 1978. New venture-capital commitments rose from \$39 million in 1977 to \$600 million in 1978, and most of this increase must have been committed before the change in the tax rate. Furthermore, even though the new capital-gains rates applied equally to all investments, between two-thirds and three-quarters of the venture-capital commitments since 1978 have been in the computer and electronics industries. Together these facts suggest that perceived market opportunities were as much a factor as lower taxes in the resurgence of venture-capital investment. Had the resurgence been largely tax-driven, investment would have been distributed more evenly across all industries.

Another policy change effective in 1978 may have played a role larger than capital-gains taxes in increasing the capital available for high technology. For the first time, pension funds were permitted to invest in "risky" start-up companies. These funds are tax-exempt, so the tax changes of 1978 had no effect on their investment patterns. But by 1984 tax-exempt sources, including pension funds, accounted for 40 percent of venture-capital investment, and foreign investors, who are not heavily affected by U.S. tax changes, contributed another 18 percent. This means that over half of venture-capital investment in 1984 was not motivated by capital-gains tax

advantages. By contrast, tax-exempt investors purchased only 23 percent of the \$80 billion in new stocks and bonds issued in 1984 by *all* U.S. corporations. These figures are a source of both encouragement and humility—encouragement in that the increased taxes on capital gains included in tax reform seem unlikely to do special damage to high-tech industries; and humility in that the figures show how little we understand of the complex effects of changes in economic policy.

The Effects of Capital Depreciation

The accelerated depreciation system was designed to favor purchases of equipment by allowing it to be written off quickly for tax purposes. This was expected to favor high-tech industries because they produce equipment for use by others, and because their own assets are heavily concentrated in equipment. However, other factors offset this apparently beneficial treatment.

For instance, the current depreciation system does not take into account the shorter life cycle of high-tech products and the equipment that manufactures them. Owners may be forced to discard or cannibalize high-tech equipment long before it reaches the end of its tax life, even under accelerated depreciation. When a tax write-off takes longer than the equipment lasts, a company appears more profitable than it really is. Thus it pays too much tax. High-tech companies are often in this situation, and therefore find even the present accelerated depreciation of little help relative to the rest of U.S. industry.

Another problem is that high-tech companies often finance their equipment with equity capital rather than with borrowed money. This is because many lenders are reluctant to loan money for highly specialized equipment that is unique to the company that uses it—as is frequently the case in high technology—since there would be no market for resale in case of default and repossession. So the company has to acquire equipment with funds obtained by issuing stock instead. Such equity financing costs more than debt financing, in part because it does not involve interest payments, which the company can deduct. This reduces the tax advantage that rapid depreciation was intended to confer on high-tech equipment.

Recent history suggests that shorter depreciation may not be essential to the performance of high-tech



companies. Before 1981, for example, computers could be depreciated in as little as two or three years. Then computers were assigned to a five-year depreciation category, which effectively raised the tax rate. But despite this change, the demand for computers and office equipment continued to grow rapidly, accounting for two-thirds of the increase in all spending for business equipment from 1979 to 1984.

Both the president's tax reform proposal and the House version eliminate the investment tax credit, extend the depreciation period, and retain the deduction of interest payments. But on balance this tax reform might not change the relative position of high-tech industries: they draw little special benefit from the current system, and they would continue to benefit little under the reform proposals.

Financial Assistance and Political Reality

The present debate over tax reform occurs at a time when the international competitiveness of U.S. high-tech industries is continuing to erode. In 1982, for example, imports of technology-intensive capital goods accounted for 26 percent of the U.S. market. Only two years later this had risen to over 40 percent. At the same time, the U.S. share of the world market for many leading-edge technologies fell dramatically. The U.S. share of the world market for high-density semiconductor memories dropped from

70 percent in 1979 to 30 percent in 1984, for example. These events have raised concern that the government assistance now provided to high technology is inadequate, ineffective, or both.

The most fundamental assistance the federal government could provide would be fiscal and monetary policies that promote balanced, stable industrial growth and strong export markets. Large federal deficits help raise the value of the dollar, which in turn has made American goods more costly abroad and imported goods cheaper at home. This disadvantage particularly affects high-technology companies, which produce over one-third of all U.S. exports.

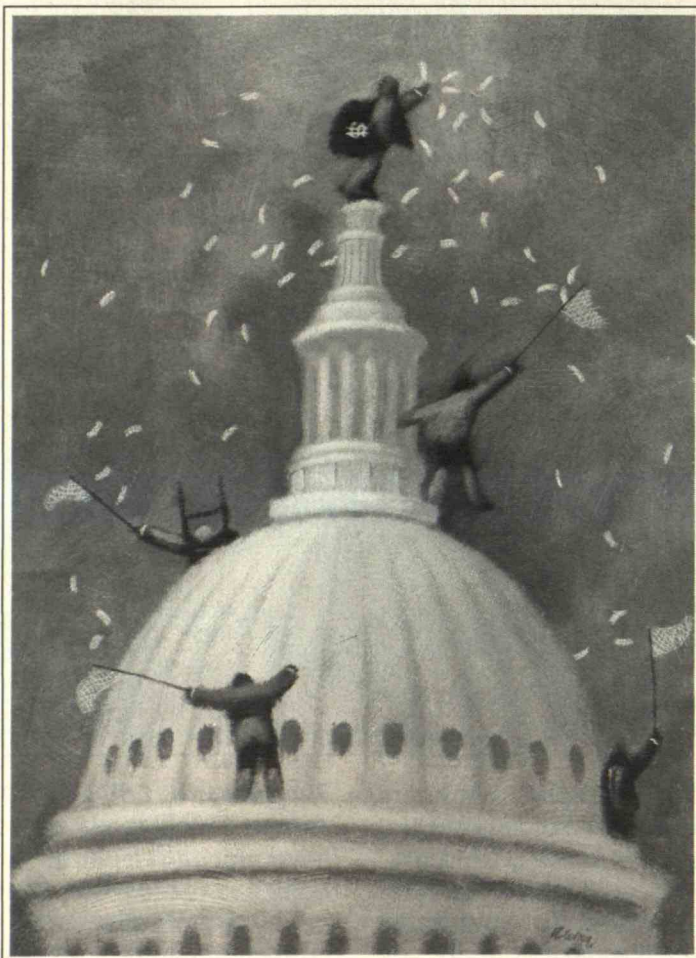
Beyond improving our foreign trade policy, making our complex tax system more rational would surely boost U.S. economic performance as a whole. This is because the encrusted layers of special provisions—worth \$365 billion in 1985—pull against one another and serve no objective well, including raising revenues.

The high-technology industries would have little to lose from the proposed reform—and perhaps much to gain. Their current tax preferences are mixed in their effectiveness. Some, like the expensing of R&D costs and limited partnerships, appear to provide timely and focused assistance. Others, like the R&D tax credit and the special tax treatment of capital gains and investments, appear weak and

poorly targeted. Similarly, the low tax rates on capital gains and investment appear to have conferred few benefits on high technology. The tax reforms proposed by the president and House would retain the most effective provisions for high technology—the expensing of R&D costs and the RDLP. The least effective—the R&D tax credit and the special treatment for capital investments and capital gains—would be reduced.

Of course, like any proposal that requires specific, visible cutbacks in exchange for widespread, future benefits, general tax reform could prove politically infeasible. Should general tax reform fail, Congress should consider improving current high-tech tax preferences.

In particular, several options are available to improve the incremental R&D tax credit. A tax credit in the range of 5 percent, made applicable to *all* R&D expenses, would have many advantages. It would provide the same total support for research as the present credit, but it would be simpler and more predictable, so that firms could better use the tax incentives in planning their research. Also, because it would reward all R&D investments, it would remove the incentive to postpone R&D projects. However, such a credit would provide a windfall for high-tech companies that would have undertaken their research anyway—an outcome Congress usually strives to avoid.



*We should lower
our expectations for the tax code as a
catalyst for economic change.*

It is important, however, to balance tax changes made in the name of efficiency against the disruptions caused by change. The investment tax credit, for example, has been changed eight times since its enactment in 1962. Similarly, the currently planned renewal of the R&D tax credit would extend only three years, thus making it of questionable benefit for long research campaigns. Changes, once made, should be retained long enough to affect the research they are intended to support.

Finally, we should learn to have more modest expectations of the tax code in influencing economic behavior. Tax incentives often interact with the realities of economic life in ways that cannot be foreseen. The

tendency of high-tech companies to finance with equity and so miss the favorable treatment afforded debt is one example of this. Another is the fact that roughly half of all U.S. corporations pay no taxes now. Furthermore, some \$16 billion in unused investment tax credits must be carried forward every year. Providing such companies with further tax benefits is like showing movies to the blind.

Thus improvements in the tax code, whether general or specific to high-tech industries, may not have a decisive influence on industrial research and its commercial application. The high-technology engine of growth is not wholly, or perhaps even principally, fueled by public subsidies. □

Building blocks for what will become an electronics factory of the future are being set in place at Hughes Aircraft Company to cut costs in manufacturing airborne radars and other avionics programs. Lasers, fiber optics, remote fiber fluorometry, and advanced optics play a part in an Industrial Modernization Incentive Program (IMIP) contract awarded by the U.S. Navy with Air Force participation. IMIP is a share-the-savings concept to reduce costs of the F-14, F-15, and F/A-18 Hornet Strike Fighter radar programs by more than \$10 million, while improving the quality and reliability of the systems. Three projects employing new manufacturing technology focus on solder joint inspection, metal fabrication inspection, and continuous chemical analysis of solutions used in electroplating printed wiring boards.

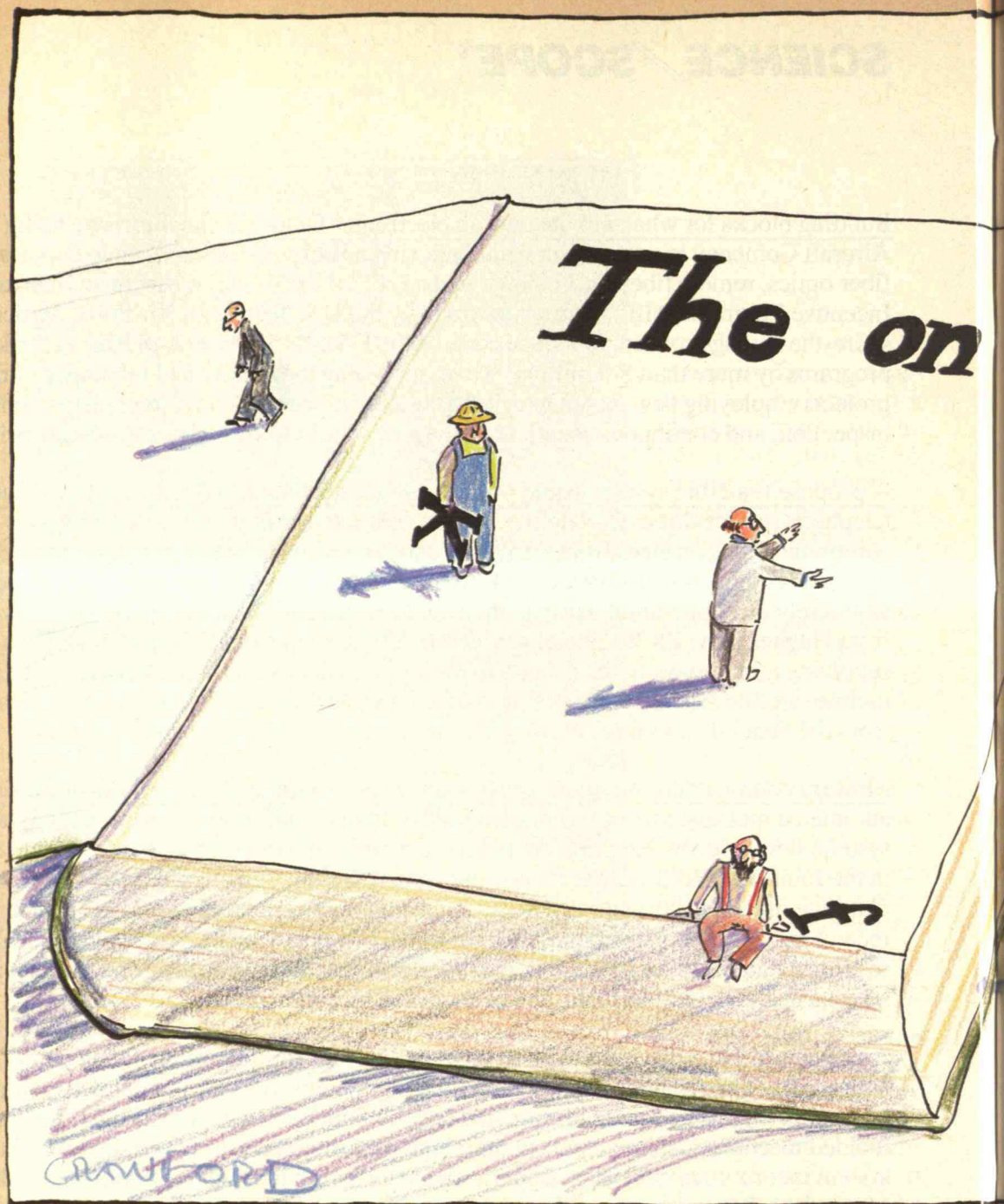
A proposed satellite system would provide mobile telephone and radio communications and rural telephone service direct via satellite. The mobile satellite network would relay two-way voice and data communications services from airplanes, cars, trains, or remote locations. Each vehicle or location would be equipped with antennas that will vary in size and power depending on users' needs. The system would rely on cooperation between the United States and Canada, each of which would provide a satellite from Hughes' new HS 393 line of spacecraft. The system would employ an antenna technique for supplying more power to the ground in most places than an ordinary antenna—the key element in a mobile satellite system. Hughes Communications Mobile Satellite Services, Inc. is seeking authorization from the Federal Communications Commission to operate the system.

Military commanders at separate headquarters can share up-to-the-minute information, thanks to a new automated message processing system for Command and Control Information Systems (CCIS). The system, developed by Hughes, handles a wide range of formatted and unformatted messages as specified in the Joint US/NATO military reporting system. It will dramatically lessen the time needed to update planning, intelligence, and force status information in command and control systems. The system can receive messages over a variety of digital links. Messages can be drawn automatically from complex relational databases, or be used to update information automatically. Information can be displayed on screens in a variety of formats, and be modified by commanders.

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Squaring Off at the Table, Not in the Courts

BY LAWRENCE SUSSKIND AND LAURA VAN DAM

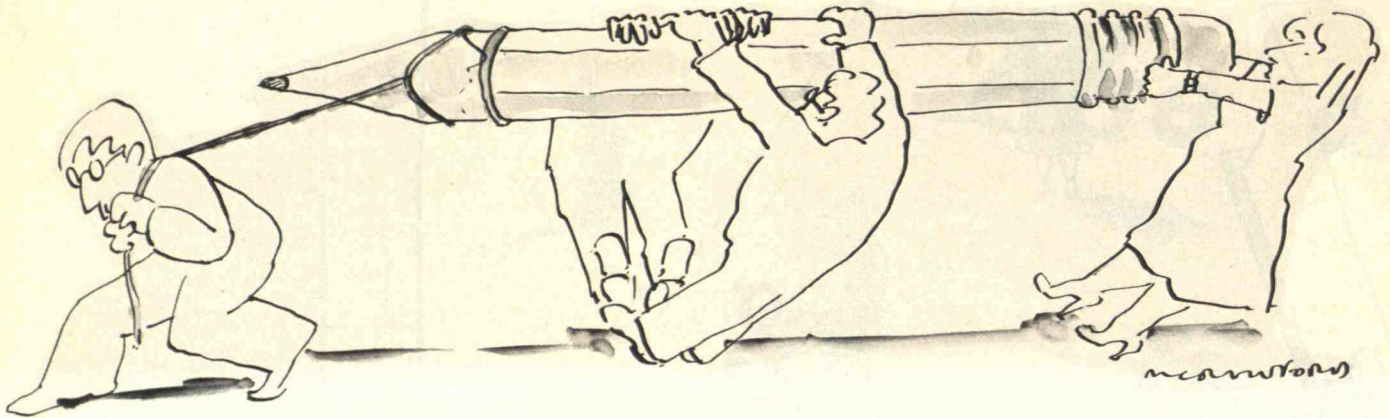
All too often government regulations end up as the subject of lawsuits. We could reduce this wrangling if the opposing sides drafted the regulations together.



IN late 1978, the U.S. Congress ordered the Environmental Protection Agency to develop standards governing the cleanup and disposal of uranium mill-tailings. Almost five years later, the agency finished issuing its rules. Despite its technical research, public hearings, and attempts to heed the comments made during the six-month public review and comment period, it was sued. Not until late 1985, seven years after the process began, did the court uphold the rules, excepting one provision.

Such a time-consuming process would be unfortunate even if this were an isolated case. But consider that about four of every five rules that the EPA promulgates are challenged in court. Not only is time wasted, but the courts often prove to be inappro-

*Negotiation could
produce wiser rules by eliminating
the growing use of
advocacy science.*



appropriate arbiters of technical regulatory disputes. It's no wonder that many people think the rule-making process no longer works.

Today, an alternative called "negotiated rule-making" offers great promise. The process involves gathering all interested parties together to hammer out a rule they can agree on. Informally known as "regneg," for "regulatory negotiation," this alternative could reduce court caseloads and increase agencies' speed in issuing rules. It also could produce wiser rules by eliminating the growing use of "advocacy science," in which concerned parties pay experts to undercut opponents' scientific claims. Advocacy science gradually is eroding the credibility of all scientific testimony in public disputes.

To test negotiated rule-making, the EPA has conducted several demonstrations of the process in the 1980s. For starters, it concentrated on a regulation that concerned truck emission standards. Once this was completed in 1984, the agency chose a rule focusing on the criteria for issuing emergency exemptions from pesticide-licensing regulations. Such exemptions allow farmers to use pesticides that are still undergoing tests for health risks. The Public Disputes Program, which is part of the Program on Negotiations at Harvard Law School, monitored the two demonstrations for the EPA. Both have been

successful: no one challenged the negotiated rules in court. Plus, the rules took less than the standard two years to promulgate.

Of course, two demonstrations are not a complete proof. Earlier this year, during a third EPA demonstration of negotiated rule-making, which concerned pesticide protection for farmworkers, several farmworkers' representatives stopped attending meetings. They alleged that the proceedings had not been conducted fairly. The EPA continued to meet with the scaled-down negotiating group, leaving the door open for the farmworkers to return or at least comment on the draft regulations before the formal review and comment stage.

The EPA's demonstrations of negotiated rule-making and similar tests by other federal agencies have shed light on how and when negotiation can—and cannot—be used to develop regulations. Usually, regulations can be negotiated if they involve several issues that negotiators value differently. Then the participants can make trades. A regulation typically cannot be negotiated when it centers on a single emotionally charged issue. People are unlikely to resolve disputes if they have to compromise deeply held beliefs.

From Neighborhoods to Federal Agencies

Mediated negotiation was tested for the first time as an alternative to litigation in the late 1960s, when experimental neighborhood justice centers tried to help residents informally handle such problems as landlord-tenant clashes. The idea caught on, and by the mid-1970s, what had become known as "alternative dispute resolution" was being used to settle

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all kinds of complex disagreements. For example, governmental bodies began using mediated negotiation successfully to decide where to locate highways, landfills, and airports.

By 1985, more than 25 dispute-resolution organizations had formed to help mediate a range of public disputes, from electricity-rate squabbles to controversies about the licensing of waste-treatment plants. Also, several federal agencies had recognized that they could apply negotiation techniques to potential regulatory conflicts. Now, the EPA, the Federal Aviation Administration, and the Occupational Safety and Health Administration have actually experimented with that process.

At the EPA, the idea of developing rules through negotiation emerged during the Carter Administration. Momentum slowed with the 1981 change in administration—but only for a short time. Then Republicans bent on regulatory relief recognized that the process might be more efficient than the traditional rule-making method. In 1983, the EPA announced that it was ready to develop several regulations using negotiation.

This meant altering a little of the standard rule-making procedure. Conventionally, a federal agency relies on its in-house expertise and consults with advisory committees made up of independent experts when it drafts a proposed rule. Then it publishes the draft in the *Federal Register*. That sets the stage for individuals, organizations, and even other government agencies to respond during a formal review and comment period. The agency must justify its final version of the rule in light of all the comments it receives.

For its demonstrations of negotiated rule-making, the EPA kept most aspects of the standard procedure intact. But it convened all interested parties to help draft, by consensus, the proposed rule.

In 1983, the agency came close to negotiating a rule that would set the minimum volume of low-level radioactive waste that had to accumulate before federal hazardous-waste regulations would come into play. Very quickly, the agency learned it had made a mistake, for environmentalists said they would refuse to negotiate this topic. They said they believed that *any* amount of waste should be treated as dangerous. From this experience, the EPA realized that negotiation cannot work when the focus is on a single issue that parties will not break down into components they can trade off.

The EPA settled on two less gut-wrenching topics from a list proposed by some environmental groups initially skeptical about negotiated rule-making. First, it organized a negotiation to develop a set of financial penalties for truck-engine manufacturers who fail to meet the Clean Air Act's emission requirements. The resulting regulation, negotiated by manufacturers as well as environmentalists, allowed non-complying companies time to catch up. But it forced them to pay significant fees until they complied.

The agency also announced its intention to negotiate a rule concerning emergency exemptions from pesticide-licensing regulations. About a year earlier, a number of critics had expressed concern that the EPA was granting too many emergency exemptions.

The rule-making on emergency exemptions illustrates how consensus building can work. The EPA began by setting a strict deadline, which was intended to keep negotiators from debating indefinitely. Further, the agency recognized that the parties—including farmers, chemical manufacturers, environmentalists, and state and federal officials concerned with health, pesticides, and agriculture—had different priorities about the issue. For example, they disagreed on what should constitute an emergency. Thus, the parties could make trade-offs. In the lingo of negotiation theory, there was room for a “win-win” settlement.

After choosing the emergency-exemption rule for a demonstration, the EPA hired ERM-McGlennon Associates, a Boston environmental consulting firm with extensive negotiation experience, to organize the negotiation. ERM-McGlennon contacted more than 100 groups to learn who might want to participate. Some 16 organizations besides the EPA expressed interest in participating. These included four environmental groups, four state agencies, four farmers' associations, two manufacturing associations, and the U.S. Department of Agriculture. Six more parties were added later, after they learned of the pending negotiations through a notice in the *Federal Register* and asked to be included.

The negotiations probably could not have produced credible results without the involvement of such a diverse group of interested parties. But why were the organizations willing to participate? The reason is that they knew that a rule would be promulgated, no matter what. The offer to negotiate a

draft of the proposed rule was too attractive to pass up. Presumably, they would have a chance to influence the rule-making without having to pay for a court challenge. And the participants didn't want to miss out on a process their opponents wanted in on.

The negotiating team met for an orientation session several weeks after the *Federal Register* announcement and adopted a set of ground rules. They agreed to operate by consensus rather than majority vote. They agreed that members could call time-out to caucus in small groups whenever necessary. And they agreed to a provision that represented both a safeguard and a threat: any party could withdraw from the process at any time.

During negotiations, the participants would have ample opportunities to review drafts with their organizations. And they were assured that any regulation resulting from the negotiations would be subject to the normal public review and comment procedure.

In the introductory session, the negotiators established an agenda and organized smaller working groups. The purpose of these groups was to examine specific topics of concern. In keeping with the open character of the negotiations, anyone could choose to be a member of any working group.

One working group was set up to develop guidelines on the use of up to \$50,000 that the EPA made available to the negotiators. Half of this money had been put up by the agency, and the remainder of it had been donated by private foundations. Upon agreement from everyone, it could be used to fund fact-finding studies or to reimburse needy participants for travel and similar costs.

As it turned out, \$20,000 from the resource pool paid the travel costs of some participants who convinced the group that they needed this support to attend. No money went for research.

In some negotiations, however, groups must commission technical research together. That is what the negotiators did in the first EPA demonstration of negotiated rule-making: they selected a single researcher to design a fair method of sampling engines that would be tested for emissions. In joint fact-finding studies, the negotiators can specify the research protocols they deem reasonable. This prevents arguments about the validity of technical claims. Plus, joint research keeps some negotiators from wielding more influence because their organizations have more money for studies. Finally, joint

fact-finding means that the agency responsible for a rule does not have to choose between inconsistent facts that otherwise might be presented by different parties. Having to choose between data usually leads to opposition after a rule is developed.

During the first meeting, the EPA's Office of Pesticide Programs unexpectedly submitted an early draft it had drawn up for the emergency-exemption rule. The negotiators could have ignored that draft, since it was up to everybody to help with one. But they decided to use the document as a point of departure for their work. This not only gave them a head start but allowed the EPA to indicate what a rule promulgated under the traditional procedure might look like.

The first session also gave the negotiators a chance to become acquainted with the facilitator, the person the EPA had chosen to manage arrangements, keep the minutes, and orchestrate the consensus-building process. In any regneg, the facilitator has to make sure that everyone has a chance to talk and that the group stays on track. The facilitator must be non-partisan and acceptable to all the negotiators.

The next time the group met, on September 28, 1984, it began to negotiate in earnest. The work continued through six formal meetings, including three that lasted two working days each. Negotiations ended four months after they began. The smaller working groups met throughout this period.

At the start of negotiations participants usually wonder which parties have the most power to achieve their goals. Generally, people presume that parties with fewer financial resources or less political influence will be overwhelmed or co-opted. But negotiators who are effective in expressing their views or in inventing suggestions that others can accept are likely to come out ahead. So are participants who back their claims with solid evidence or who build working relationships by listening well. And less politically powerful participants can increase their influence by forming coalitions.

That is what the environmentalists did in the rule-making on emergency exemptions. Instead of attending a casual dinner the facilitator hosted before the second meeting of the negotiators, the environmental representatives met to develop a coalition strategy and work out their differences. This separate meeting initially upset some other negotiators, but everyone soon realized that coalition building was key to the negotiation process. In fact, behind-the-

MIT

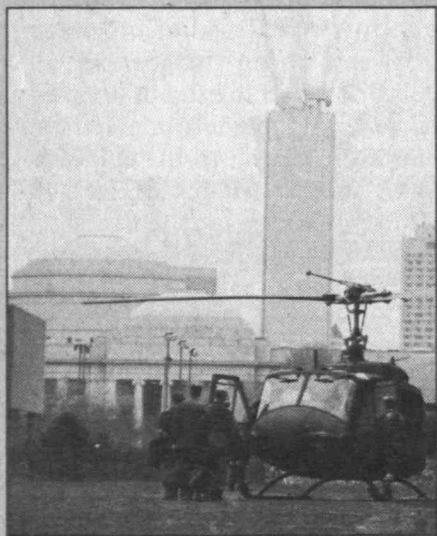
JULY 1986

ROTC: Military Science Comes of Age



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ABOUT THE COVER

UH-1 helicopters arriving at Briggs Field to transport Army cadets to their spring field training may look dramatic, but the reality of ROTC on campus is a very workmanlike fostering of communication skills and leadership experience.

As *Boston Magazine* observed, "you know the military's in trouble when it can be outshot at its own game by a gang of pistol-packing engineers from M.I.T."

Last spring, M.I.T. was the first civilian school to win two gold medals at the National Intercollegiate Pistol Championships. But not to worry, the nation's defense is still fairly secure: many of the M.I.T. marksmen are members of ROTC units. Tech scored 2,111 out of a possible 2,400 points in the standard-pistol event, 26 points ahead of Air Force, and beat Citadel, a South Carolina military college, for the medal in air-pistol.

Joseph LaRocca, '87, was the highest M.I.T. air-pistol scorer; he was named an All-American, as was Jerry Martin, '86. "We always knew we were the best civilian team," LaRocca says. "It was good to know that given the other pressures we have here and the less strict practice time, we could still beat the military schools."

• The spring sports season has had other notable events, as well.

The women's Athlete of the Year title went to Grace Saccardo, '86, a Course VI major who starred in three varsity sports—basketball, softball, and soccer. Saccardo's performance on the court was featured in May/June, pp. MIT 2-3.

Men's Athlete of the Year was Craig Poole, '86. Poole scored 1,100 points during his four years on the basketball team, including a game-high of 33 points, that made him M.I.T.'s ninth all-time scorer. But that just kept him busy until the opening of the season for baseball, his first love. A starter each of his four years on the squad, Poole has become a role model for kids from his small Virginia hometown, Exmore. He has no regrets about playing more than 200 intercollegiate games in the two sports, and no regrets about coming to M.I.T., although the challenge of maintaining

KEN CERINO is bowing out as M.I.T.'s dynamic sports publicity director to join the Office of Public Relations at Springfield College.

grades while playing sports was even more difficult than he had anticipated.

• In other baseball highlights, third baseman Tom Hoffman, '87 was named to the Greater Boston League all-star team after hitting .349 in conference play . . . Shortstop-pitcher Rich Zermani, '87 led the Engineers with a .304 average followed by outfielder Ken Switzer, '86 at .292 . . . Highlight of the season was a 5-4 win over Brandeis in the season opener in St. Petersburg, Fla. It was the first time since 1973 that M.I.T. had been beaten the Judges on the diamond . . . M.I.T. finished with a 8-17 record against strong competition, beating Division 1 rival Boston University (11-9 in 10 innings), Dartmouth (14-9), Harvard (4-2 and 3-2), and Northeastern.

• It was an outstanding season for men's tennis: The Engineers had a 13-4 record for their best mark ever . . . Ranked as high as 11th nationally, M.I.T. had a 10-1 record against Division III competition and beat three Division I teams (Universities of Connecticut, Massachusetts, and Vermont) . . . Tech also won the New England Championships over 30 schools for the first time, with finalists in all nine flights . . . At the New Englands, Ramy Rizk, '86 won the number one singles, Rob Craig, '86 took the number three singles crown, and Brian Brown, '89 and George Lyden, '88 won the number four and six singles positions, respectively . . . Brown and Kaiyee Ho, '89 also won the number three doubles . . . Just as important, M.I.T. received the Team Sportsmanship Award, while Craig was honored for Outstanding Individual Sportsmanship during the three-day event. . . . Rizk and Ben Spehlmann, '88 participated in the NCAA Division III Championships in Claremont, Calif.; despite losing opening matches in singles and doubles, they became the first M.I.T. players ever to qualify for the nationals.

The women's tennis team completed an abbreviated spring season with a 3-2 record after posting a 5-7 mark in the fall . . . At the Middle States Collegiate



It's been a particularly fine season for the folks at left (from top): Sailing coach Hatch Brown was inducted into the Hall of Fame at his alma mater, Boston University. Craig Poole, '86, was named male Athlete of the Year. And Joe LaRocca, '87, led the pistol team to an unheard-of upset of the military academies at National Pistol Championships.



Championships, M.I.T. finished ninth among 19 schools.

- In outdoor track, Tech was 5-0 for its third straight unbeaten season . . . The Engineers also finished second among 28 schools at the New England Division III Championships . . . At the NE Division III meet, Gordon Holterman, '86 won the 1500-meter run while Bobb White, '87 captured the pole vault.

- The Engineers were among the top teams in New England in men's volleyball after posting a 25-10 record in their first season of varsity competition . . . M.I.T. was also champion of the Northeast Conference of the Eastern Intercollegiate Volleyball Association and the New England College Volleyball League and advanced to the NCAA qualifier before losing . . . In the final national ranking, M.I.T. tied for 20th with Princeton.

- Coach Jack Barry's golf team built on past success, posting a 13-3 record (4-1 in the fall, 9-2 in the spring) for its fifth straight winning season . . . Eric Asel '87 finished second among 103 golfers at the Massachusetts Intercollegiate Association Championships and participated in the NCAA Division II Championships for the third consecutive year . . . The Engineers were nationally-ranked for the first time (18th) and ranked second in New England behind Salem State.

- Probably the most improved team at M.I.T. this year was in varsity lacrosse, which had a 6-7 in 1986 record after winning only one game in 1985 . . . Mike Foley, '87 led the team in scoring with 39 points (24 goals, 15 assists) . . . Jim Masucci, '86 received the Ben Martin Award for dedication, determination, and spirit.

- Under the direction of first-year Coach Bruce Beall, the Engineers posted a 3-4 record in men's heavyweight crew. They beat Columbia for the second straight time in the Alumni Cup, and passed Coast Guard and Dartmouth to win the Cochrane Cup.

In men's lightweight crew, the young Engineers were 0-6, but did have the pleasure of beating Columbia in the Eastern sprints after the Lions knocked off M.I.T. earlier in the year . . . The freshman lightweight squad had an outstanding season finishing with a 4-3 record while placing third among 11 schools at the Eastern Sprints.

It was a busy spring for Tech women's crew, who beat Columbia, Purdue, Rutgers, Worcester Polytechnic, and Northeastern on their way to a 5-6 mark for the season. M.I.T. also placed third at the New England Championships.

- The varsity sailing team competed in 13 regattas. They won the Shields Invitational at Coast Guard Academy, finished fourth among 11 teams at the Boston University Trophy on the Charles River, and just missed the finals of the New England Team-Race (Fowle Trophy) Championships.

Junior Louise Sedlacek was the first woman captain in the 50-year history of M.I.T. sailing, and was elected the MVP for 1985-86. . . . Sailing Coach Harold (Hatch) Brown was among six persons inducted into Boston University's Hall of Fame in May. Brown was the top skipper at the National Championships in 1959, the year he graduated from BU. He has been the head coach at M.I.T. since 1967.

- The women's softball team had their fourth winning season in five years, compiling a 12-7 record that included a sweet 6-1 win over Harvard in game two . . . Six starters hit over .300, with first baseman Mary Cox, '86 (.375), shortstop Stach Thompson, '86 (.375), and third baseman Diane DiMassa, '88 (.364) leading the way . . . Righthander Karen Krans, '88 was 12-7 with a fine 2.07 earned-run average. □

ROTC: From Cause Célèbre to Business as Usual

ROTC is alive and well at M.I.T., making it one of the least publicized comebacks of the 1980s. Less than 10 years ago, enrollment in the Reserve Officer Training Corps, as it is officially known, had reached an all-time low, and students walking around campus in uniform attracted sneers and cat-calls. But as the wounds left by Vietnam healed and a conservative mood has taken center stage on college campuses, ROTC has experienced an upsurge of popularity.

In 1986, no one pays particular attention when close to 10 percent of the M.I.T. undergraduate population goes about its business in green, blue, or white uniforms one or two days every week. Cadets and midshipmen from Harvard, Wellesley, and Tufts also come to M.I.T. for ROTC classes and activities, swelling the combined ranks of the Army, Navy, and Air Force units to about 500 students.

But ROTC is not impervious to historical events and social change. The M.I.T. ROTC programs that have evolved since the turmoil of the 1970s are far from the indoctrinational, "learn how to take orders" organizations they are often imagined to be. ROTC at M.I.T. now encourages its members to debate seriously the role of our nation and its military in the global society.

ROTC at M.I.T. has roots as old as the Institute itself. The Morrill Act of 1862 provided for the establishment of military training at land-grant colleges and universities, including M.I.T. From the first class in 1865 until 1958, male undergraduates who were U.S. citizens



DONALD M. DAVIDOFF '86, is a recent graduate with a degree in Aeronautics. He was a distinguished graduate of the AF-ROTC program at M.I.T. and served as corps commander for the spring term of 1986. Any opinions expressed or implied in this article are the opinions of the author or those quoted and not the opinions of any branch of the service or the Department of Defense.

Technology Review welcomes comments of alumni and alumnae on this topic.

Once rigid and in a decline, ROTC now involves 10 percent of M.I.T. students and encourages debate.

were required to participate in "military science." Students could drop out at the beginning of their junior year or continue for all four years and incur a two-year active duty commitment. President Paul E. Gray, '54, experienced compulsory ROTC as a student. "Out of a class of 800," he recalls, "as many as 200

would stay in (to be commissioned)—and that was in the days before the scholarship program."

Then came Vietnam. "During the late sixties and early seventies," remembers President Gray, "it was fashionable for

universities to throw out ROTC, particularly in New England. M.I.T., however, supported the services throughout this period." That was possible at least in part because of a 1970 compromise between the administration and concerned members of the faculty. This agreement dropped faculty status for all the ROTC staff instructors except the head of each service detachment. It was also agreed to eliminate academic credit for ROTC classes.



One moment in M.I.T.'s varied military history is captured in this photo-

graph of some of the 90 former Institute students who were Army Air

Force officers stationed at Wright Field, Ohio in 1942.

Right: "Officers of the M.I.T. student battalion, 1869," in one of the earliest visual records of military training at M.I.T. Below: Lt. Gen. James Abramson, '55, and Alphonse Fletcher, Harvard '87, good naturedly saluted "The Grog," a repulsive concoction administered to violators of protocol at the tri-service awards banquet.



Service Exchanged for Education of a Lifetime

From the drill and military science of the 1800s, all three services have evolved ROTC programs with basic similarities. They all offer merit-based four-year scholarships which include full tuition, books, and a \$100 monthly tax-free stipend during the academic year. Juniors and seniors not on scholarship do receive the stipend.

All the services have a basic requirement of four-years of active duty following graduation, with a few exceptions. Scholarship students have a contractual commitment from the start of their sophomore years, while a non-scholarship student is not bound until his or her junior year by a contract to accept active duty.

There are also differences among the three programs, the first dealing with their policies on academic majors. Air Force scholarships, for example, are offered almost exclusively for specific science and engineering degrees. The Army does not limit the degrees that cadets may pursue, while the Navy excludes only educational programs that are "not compatible" with a marine-based service.

All three services require summer training—ranging from every summer for Navy to one summer of training each for Army and Air Force. And, of course, the jobs to which cadets and midshipmen are assigned after commissioning also differ substantially.

ROTC vs. Service Academies

The prevailing opinion once held that the top military ranks were the exclusive preserve of graduates of the service academies. But in the Navy, for example, it appears that the number of ROTC midshipmen who become career officers is growing, according to Commander James Ward, executive officer of the Navy ROTC program at M.I.T. ROTC is now considered as important a source of officers of all ranks as the Naval Academy, Ward reports.

As of 1985, close to 41 percent of the Air Force's active officers were commissioned through ROTC (42,974 out of 105,385 total officers) while 43.5 percent of the Air Force's generals were commissioned through ROTC (146 of 336 generals). And one of the Air Force's most visible officers, Lieutenant General James Abrahamson, '55, the director of President Reagan's Strategic Defense Initiative (Star Wars) was commissioned through the M.I.T. ROTC program.

According to Captain Douglas Loverro, the Commandant of Cadets for the Air Force program at M.I.T. and a 1976 graduate of the Air Force Academy, there are two major issues in any comparison of ROTC and the service academies: the quality of training and education and cost.

"The environment at the academy is much more intense and stressful, and the academy graduate has a more complete background and higher knowledge level in military-related skills," Loverro says. "On the other hand, ROTC offers a chance for more specialized and perhaps better education. Furthermore, since ROTC cadets do not live such regimented lives, they tend to have a better chance to mature socially." Erberto Lozada, Harvard '86, agrees, "We have a better balance since we operate in the civilian atmosphere in which the real military works." Lozada was the highest ranking midshipman during the spring '86 term.

Loverro figures that "it costs the Air Force \$100,000 to \$150,000 to train an academy graduate versus only \$60,000 to \$70,000 to train an M.I.T. graduate, for example, and the retention rates appear to be somewhat near the same."

Special Status for the Military?

A survey by the Ad Hoc Committee on the Military Presence at M.I.T., which reported to the faculty in May, brought to light some of the general campus feelings about ROTC, particularly among students.

Questions directed at students who were not members of ROTC indicated



that 43 percent believe that the program is appropriate on campus, and more than 77 percent of those responding believe that the ROTC option should remain available.

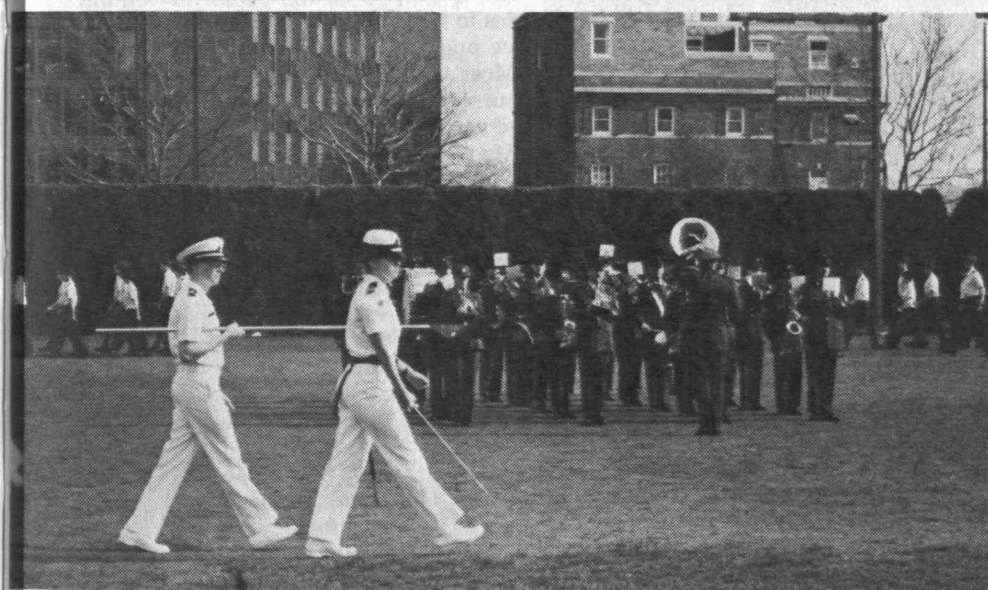
Eighty-three of the students responding, or 5 percent of the total, were ROTC members. Of these, 13 percent said they were dissatisfied with ROTC.

The opinion of the faculty on ROTC was not solicited, but several voluntarily noted their concerns about the restrictions on students' choice of majors and the lack of freedom of speech among ROTC members.

"There is no satisfactory answer to the question of why ROTC should be on campus and not the Public Health Service, or Forest Service, for example," argues Louis Menand III, whose duties as a special assistant to the provost for nine years included the liaison between the administration and ROTC detachments.



Women have experienced considerable change in their relationship with ROTC between 1957, when this queen was crowned at the Military Ball, and 1986, when Nancy Kirwan, '86, led her 60-member company of midshipmen in the pass-in-review.



qualified male must first serve in a line capacity, Ward said, whereas women may enter directly into such specialized assignments as intelligence or civil engineering.

"I agree that there is a greater variety and opportunity for women to move around, and that's good," says Edmiston, "If we want service careers, however, [being barred from combat vessels] is a definite disadvantage." Promotion in the military is often based on job responsibility, with a premium on operational command. "There aren't as many operational billets available to women and, as a result, it is difficult for them to compete."

Paige Thorner sees opportunities as "outstanding for women." Thorner is a 1986 graduate from Wellesley with a degree in history and Chinese studies. She was the Army Battalion Commander, the highest-ranking cadet, during the fall semester 1985. She also sees further improvement in the future as women now at the colonel or lieutenant colonel ranks are promoted to generals.

It is unlikely that the situation for women is quite that utopian. A member of the audience at the 1986 AMITA conference for women in technical careers said that she had been treated with stunning disrespect on occasion by her fellow Army officers. She said her experience contrasted sharply with positive picture of a military career painted by retired Air Force General and conference speaker Wilma Vaught.

The military's discrimination against homosexuals has also fueled anti-ROTC sentiment. The policy recently spurred the lesbian organization on the Wellesley campus to force a student referendum on whether the college should pull out of ROTC. Although the referendum was defeated by the students by more than 20 percentage points and won no support from the Wellesley administration, the issue is probably far from dead.

"They have a good cause, but we can't do anything about it," says Thorner. "It's up to Congress and the Supreme Court, because they're the ones who have created and supported the limita-

"Congress has decided to buy the services of college-going students for the military but not for any other type of service," says Menand. He feels this is at least unfair if not actually dangerous.

Menand, who teaches political science, also raises the issue of funding, expressing concern that "Congress is reducing funds to the needy but giving a free ride to college officer candidates." He believes that the military should rely on post-graduation recruiting like every other organization in our society, and the money now spent on ROTC should be made available to "more appropriate social programs."

Women in ROTC: Debatable Advantages

ROTC's most vocal opponents at M.I.T., however, have focused on issues of discrimination. In the first place, the mili-

tary discriminates against women. Women have been admitted to ROTC since the early seventies and they comprise some 20 percent of the M.I.T.-based contingents. But in active service, women are not allowed to fly combat aircraft or serve in infantry or combat armor divisions. In the Navy, women are prohibited from serving on combat vessels.

Surprisingly few of the women in ROTC to whom I spoke were bothered by their exclusion from combat-related responsibilities. In fact, Becky Edmiston, '87, a political science major in the Navy program, was quick to point out that "the military itself is not against women in combat, but Congress has not allowed it."

Commander Ward argues that women in the Navy actually "have more freedom," and are offered a much wider variety of career fields. Any physically

Human muscle-power may have little to do with the conduct of modern military action, but it still has everything to do with success in modern military training—for both sexes.



tion. [The gay activists] don't seem to want to listen to our side. I can't see eliminating ROTC for some students just because others can't participate."

A Big Return on Investment

Inside the program, ROTC members are convinced that they are getting much more than their scholarships for their efforts.

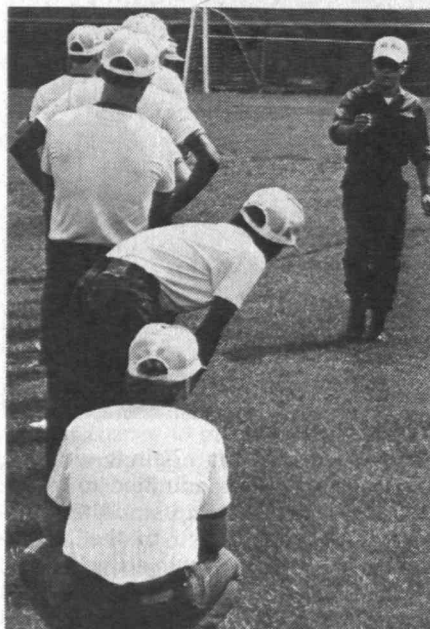
"The main stereotype is that people in ROTC are either in it for the money or are super gung-ho," says David Graham, '87, a mechanical engineering major in the Air Force program. "There are a lot of shades in between. I joined for the scholarship, but the I'm staying because the Air Force is a good opportunity for a first job. I'll get immediate responsibility when I graduate; with any other job, I'd just be a peon."

Gregory Greeley, '86, a computer science major, also joined the Air Force for the scholarship, "but I've stayed because I really enjoy the program. It's really helped me speak in front of people. I also like the fact that I'm not committed to a career path. I really don't know what I want to do, and I don't have to make that decision until I've finished my four years." (Greeley was commissioned as a second lieutenant last month, and he is pursuing a master's degree at M.I.T. prior to active duty.)

"ROTC gives us a chance to work with a bureaucracy and make mistakes," notes Eriberto Lozada. "The experience we get here is the experience most people get only in the real world—budgeting, time tables, reports, etc. You can't afford mistakes in the business world, so you don't take risks. Here we take those risks and learn from them," Lozada finds.

"We give an opportunity to exercise leadership skills," adds Ward, "It's difficult to develop leadership without doing it."

Commander Ward observes that "when students find themselves under a lot of pressure, they often isolate themselves. Corps activities, particularly the socially-related ones, limit the students'



ability to remain isolated."

Furthermore, ROTC programs have come to grips with several important issues with which M.I.T. itself is wrestling. Recent committees on curricular reform note the inability of M.I.T. students to see how their skills could be applied to meet society's most pressing needs. Such committees express concern about students' deficiencies in expressing themselves and their lack of cohesive knowledge of the liberal arts.

All the M.I.T. ROTC programs require cadets to prepare both written and oral presentations. "In the corporate world,

every person needs good stage presence, and it's one thing schools don't teach," says Captain Loverro. "We concentrate on this—one of the goals for each ROTC class from freshmen through senior year is to improve the speaking and writing skills."

In his senior class Captain Loverro tries to help his students develop initiative and the ability to think critically. "Most students go through academic courses and are given assignments that are very limited in scope," he believes, "My cadets pick some subject and teach the senior ROTC class for one-and-a-half-hour session."

"Last term I assigned debates covering topics from how to deal with apartheid to whether or not the U.S. should maintain a presence in Central America. M.I.T. students need more work (dealing with thorny topics in a forum setting), probably because they've never been asked to defend their assertions and think on their feet," says Lovero. "However, you'll find the need to think quickly anywhere in the corporate or military world, and we're trying to prepare our cadets for that."

Thorner says that the Army program covers topics on military versus civil law, military history, and case studies in ethics. "We have open discussions on Vietnam, the military and politics, and other topics. . . . It makes us think."

Says Thorner, "Whether or not cadets stay in ROTC doesn't matter. They learn leadership, how to get comfortable in front of people, and how to be confident. These are all things I value and am not taught in the classroom at Wellesley or M.I.T."

Adds James Ward, "Students in the program must come to grip with what role our country plays in the world, and I think every citizen should do this."

"There is a need for the liberally educated officer," says Lozada, "who sees both the military and civilian side. The citizen soldier. One who can see beyond his or her little world to (understand) how it affects other worlds—one who sees the 'big picture.' That's what we're being taught right here." □



M.I.T. celebrated its 125th anniversary with a format both festive and intellectual. A Sustaining Fellows symposium on the world economy featured Nobel laureate Franco Modigliani (below). A ball drew some 1,000 celebrants—including (above, L. to R.) Breene Kerr, '51, Sherry Kerr, and James Baker, '54—who were treated to a chorus of "Take Me Back to Tech," by (lower right, L. to R.) Bernard J. Klim, '55; Mr. Klim's former roommate, Paul E. Gray, '54; John Horton, '49; and two members of the Logarythms.



Deficit: the Root of the Contemporary Fiscal Morass

The world's most serious economic ills—a burgeoning trade deficit in the United States, depression in Europe, debt default in the Third World—can be laid on the United States' doorstep. The villain is the U.S. budget deficit—annually four to five percent of gross national product, "absolutely unprecedented in peacetime in the United States," says Professor Franco Modigliani of M.I.T.

"The solution to every economic problem begins with cutting the U.S. deficit," said Nobel-laureate Modigliani at a special Quasiquicentennial symposium for the M.I.T. Sustaining Fellows on April 26. The symposium focused on the future of the world economy.

Modigliani was joined before the Sustaining Fellows by a panel of distinguished and outspoken economists and businessmen—Professor Rudiger Dornbusch of M.I.T., Professor Hendrik S. Houthakker of Harvard, Samuel W. Bodman III, Ph.D.'64, president and chief operating officer of FMR Corp., and Alexander V. d'Arbeloff, '49, chairman and president of Teradyne, Inc.

Modigliani's argument rests on his

conclusion that the deficit is the cause of high U.S. interest rates, which are the worldwide culprit. Though we tend to think that interest rates have fallen from historic highs in the early 1980s, that's an illusion, said Modigliani. It's the rate of inflation that's fallen—real U.S. interest rates are almost as high as ever.

The first and most obvious effect of high interest rates, said Modigliani, is to attract foreign capital to U.S. lenders. The resulting scramble for dollars inflates the value of the dollar overseas, with consequences familiar to most of us: high prices and hence poor markets for American goods overseas, low prices and high demand for foreign goods in the United States, together leading to a

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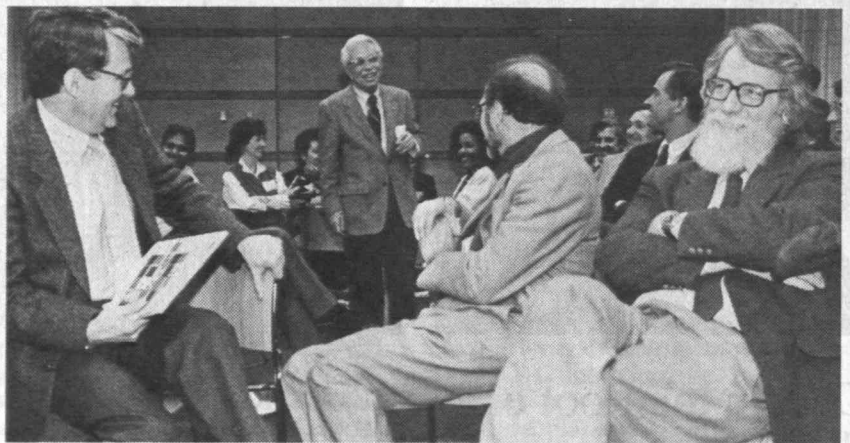
large deficit in this country's trade balance.

By contrast, though the Common Market countries—the major nations of western Europe—follow conservative financial policies and generally have balanced budgets, their economies are stagnant. That's because European capital that might be invested in growth at home is drawn to the U.S. by our high interest rates. Hence a dismal economic picture in all of Europe, with average unemployment at 11 percent, in Spain as high as 20 percent.

Professor Dornbusch emphasized yet another result of the dollar's high value: depression and foreclosures in the U.S. farm sector. But there is one small bright spot on this otherwise dark cloud, Dornbusch admitted: the relatively low prices

of imported goods have helped stem U.S. inflation even while tipping the balance of trade against us.

Meanwhile, high interest rates born of the U.S. deficit have been devastating in the Third World, said Modigliani—especially in those countries that are heavily in debt. Most Third-World debts were negotiated with "floating" interest rates at a time when rates were low. High interest has made these debts an unexpected cash and crippling burden. Whatever these countries can generate goes to pay interest on their debts; growth is stifled. Importing from the industrial countries—including the U.S.—is out of the question for Third World countries; at the same time, selling their goods in the U.S. is necessary to raise money for interest payments. All this



Some 100 of the graduates of M.I.T.'s master of city planning program returned in April to mark the 50th anniversary of the program. A series of panels dealt with issues like the void in housing policy left by the withdrawal of the federal government. There was a tribute to John T. Howard, '35, a long-time head of the planning department, and much hilarity on a harbor cruise, enjoyed by (L. to R.) Mel Levine, '56, and Frank O'Brien, '60. (Photos by Rosalyn Gerstein)

adds to the U.S. negative trade balance.

This pressure to service debts at high interest rates has still more serious repercussions for Third World countries: deliberate inflation, to reduce real wages; and reduced social programs. Both developments add to insecurity for workers—and that in turn tends to increase birth rates, said Dornbusch. The compounding crises hold the potential for collapse of the social order. "Unless we cut interest rates very significantly, we'll be sending the Marines to Latin America," Dornbusch said.

Needed: A New Administration

What about the recent decreases in the value of the dollar? A step in the right direction, admitted Harvard's Houthakker, but it fails to attack the root problem of high interest rates. Without relief from those, Common Market economies will remain depressed, unable to buy substantial quantities of American goods, whatever their price.

To d'Arbeloff, however, the problem is not overseas markets but overseas competition. The Japanese can make things better and cheaper than we, with better disciplined and lower-paid workers than in the United States. The U.S. electronics industry is just emerging from a depression, said d'Arbeloff, and a new era in its growth is "centrally dependent on semiconductors." But Japan is stealing U.S. markets for semiconductors. "If we can't compete in this field, what else is left?"

In this environment, admitted Houthakker, protectionism to prevent foreign inroads into American markets is tempting. But that, too, fails to attack the root problem. "Our trade problems are . . . due not to the failure of American business but to our propensity for deficits," Houthakker said.

Even if we understand all these reasons for doing so, can the United States really cut its deficit without a draconian measure such as Gramm-Rudman, Modigliani was asked. He says yes. Modigliani rejects the argument that deficits are indigenous to democracies—that the political process provides

no incentive for government to spend only what wage earners are willing to pay in taxes. When earlier administrations wanted to balance the budget, said Modigliani they could do so.

"We don't need a Gramm-Rudman Amendment. We need an amended administration," he said.

Sustaining Fellows Balance Sombre Thought With Festivity

If the economists' views were disquieting, there was no evidence of low spirits among the Sustaining Fellows at the end of the day, when they adjourned to Boston's Meridien Hotel for a formal dinner and then to Cambridge for M.I.T.'s 125th Anniversary Ball.

The dinner was the occasion for tribute to the Sustaining Fellows by President Paul E. Gray, '54. They are, he said, a source of "invaluable discretionary funds" that have launched important new projects. Among these are 1985-86 studies for a new integration of the liberal arts and technology. The challenge is nothing short of developing a new kind of education for the 21st century, said President Gray. "We must learn how to educate men and women who are comfortable in the human as well as technical aspects of tomorrow's world." □

Tuition Rises, But So Do Scholarships

Tuition for 1986-87 will be \$11,800, up 7.3 percent, and board and room charges will average \$4,350, an increase of less than 3 percent over 1985-86. Total average costs for two terms will thus be \$16,150 next year, compared with \$15,230 this year.

But for needy students the increases will be covered by scholarship funds so that there will be no change in the self-help level—the amount of money each recipient of student aid funds is expected to borrow or earn before scholarship grants are made available.

Stabilizing the self-help level won plaudits from *The Tech*, which noted that

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M.I.T.'s self-help level has been "significantly higher" than at "comparable" institutions such as Ivy League schools. The gap will presumably be narrowed—but not closed—by M.I.T.'s unchanged 1986-87 rate. □

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Low Loan Defaults

Students who borrow money to attend M.I.T. have a substantially better repayment record than the national average, according to Leonard V. Gallagher, '54, director of student financial aid, and Ann S. McCormick, assistant bursar. While the national default rate on National Direct Student Loans (NDSL) was 10.4 percent in 1982, the M.I.T. rate was only 2.69 percent. In the same year, the default rate on loans made directly to students by M.I.T. was only 1.8 percent. □

Fewer Freshmen But More Women, Minorities

When the Class of 1990 arrives in Cambridge this fall, it will be fewer in number than any in the last 13 years. But it will almost surely include more women and more minority students than any class in the Institute's history.

The smaller size—the target is a total of 975 freshmen—is prompted by a housing shortage for undergraduates. There has been serious dormitory overcrowding in several recent years, with single rooms turned into doubles and doubles into triples, and the smaller class is planned to reduce that problem.

The class was chosen from a pool of 6,212 final applicants—more than ever before. If enrollments occur in the same proportion as past classes, there will be about 370 women in the class and some 110 minority students—blacks, hispanics, and native Americans. Both figures are up—a breakthrough that the Admissions Office has been seeking for several years, says Michael C. Behnke, director of admissions.

Special weekend visits to campus were offered to both women and minority students to encourage their awareness of M.I.T. and encourage them to accept admission. □

08

Harold S. Osborne, '08, class secretary and the oldest alumnus attending Technology Day for the last few years, died at home on December 29, 1985; he was 98.

Dr. Osborne retired as chief engineer with AT&T in 1952, culminating a career of more than 40 years with the Bell Telephone System. Among his many achievements was a scientific breakthrough which made possible long distance direct dialing. After retirement, he served as an international consultant and traveled to many parts of the world in that capacity and as president of the International Electrotechnical Commission.

In addition to being one of the world's leading electrical engineers, Dr. Osborne was a former director of the Department of Public Works and mayor of Montclair, N.J. "Dr. Osborne, however, will not be remembered by those who knew him for his technical expertise, which literally has bound the world together with astonishing speed in the field of communications, but for his determination to bind together all elements of our community for the common good," says a *Montclair Times* editorial. "His death is a great loss to Montclair, but the legacy of this brilliant engineer with an intense desire to make the world better will long endure."—ed.



Harold Osborne, '08

09

"People should be efficient"—**Harold Stewart, '09**, shared a bit of advice when he was honored by the city of Rochester, N.Y., on its 150th birthday and his 100th birthday on January 29, 1984. "I was ambitious and wanted to do things, so I made a point to get closely acquainted with others interested in doing the same. And then we worked hard . . . and efficiently," he said.

Mr. Stewart, a lifelong resident of Rochester, died February 15, 1986, at age 101. After receiving his master's degree in electrical engineering from M.I.T., he went on to a varied career in electrical and industrial engineering. He designed machinery for Lowenthal Knitting Mills and Voght Co. (now Vopex Corp.).—ed.



Harold Stewart (1884-1986), one of 64 students receiving electrical engineering degrees in 1909, after graduating began convincing industry to switch from water and steam power to electrical power.

18

Leonard Levine sent me a news note of a review of a book entitled *A Century of Electrical Engineering and Computer Science 1882-1982*. In particular, our Professor Dugald Jackson was the prime mover. I quote the review as follows:

"When Jackson took over, electrical engineering meant electric power: railroads, dams, dynamos. It was Jackson who turned the curriculum toward electronics and communications. He hired faculty to teach mathematics, physics, mechanics, thermodynamics. He built the graduate program, fostering specialization among large numbers of able young engineers, including Vannevar Bush.

"M.I.T. had grown into a national university with the advent of World War I, and it had been forced to turn to industry for financial backing when the deal with Harvard fell through. But it was with World War II that things really took off. The Radiation Laboratory in Lincoln, with its radars and silicon diodes, is the best known; but it was the Servomechanisms Laboratory that the authors say provided the bridge to the postwar world, giving birth to a wide segment of the computer industry."

Herb Larner as usual is involved in what is going on as in the case with U.S. Senator Jesse Helms and the problems in South Africa. He reminds me that those who are constructing South African shanties on the campus reflect on the words of that sage Yankee philosopher Oliver Wendell Holmes who opined "M.I.T. students who seek equality will find it in the nearby Mt. Auburn cemetery."

We extend our sympathy to the wife and two daughters of **Walter H. Robertson**, who passed away on January 12, 1986. He had been in failing health and memory, but did recall until the very end his happy times at M.I.T. reunions with his dear friends and colleagues.—**Max Seltzer**, Secretary, 865 Central Ave., Needham, MA 02192; **Leonard Levine**, Assistant Secretary, 519 Washington St., Brookline, MA 02146

19

Looking back through the years, some class of 1919 members devoted much time and interest to

our class, and we are all indebted to them. Among these, the name of **Gene Smoley** stands tall. For most of the years past, he was our class secretary and did a superb job. Beside him all the while was his wife, affectionately known as "Twink," and her interest continues today, as you may note from the following letter from **Donald Way**. "While spending a few weeks in Florida in February and March, my wife and I called on 'Twink.' We found her in good spirits, in good health, and still interested in the class. She is getting ready to move from Florida to La Jolla, Calif., within the next month or so to be near one of her daughters."

We are indebted to the Alumni Association for notice on the death of **Henry B. Blumberg** on December 28, 1985, at his home in Lackahoe, N.Y. A letter from his surviving daughter, Mrs. Helen Greene of Sea Cliff, N.Y., reads, "Thank you for your birthday card for my dad on his 90th birthday. He had a massive stroke on his birthday and went without pain. He drove a car on December 24. He did all his own cooking and shopping, was very sharp mentally, had a marvelous sense of humor, he was a character. We all miss him because he had such a zest for living. Thank you for remembering him." We regret the passing of Mr. Blumberg and appreciate the devotion of his daughter. . . . And so until next issue, have a good summer.—**W. I. Langille**, Secretary, Box 144, Gladstone, NJ 07934, (201) 234-0690

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It was good to hear from old friend and classmate, **Karl Bean**, who has lived in Yarmouthport for many years. Karl is holding the fort while his wife is in a nursing home in South Yarmouth. He gets to see her every day, lucky fellow. Karl played the violin in the Tech Show orchestra where I played the cello. He had planned to attend the 65th but couldn't on account of his wife's health. We wish him well. Your secretary hopes to hear from you.—**Harold Bugbee**, Secretary, 702 Country Club Heights, 3 Rehabilitation Way, Woburn, MA 01801

21

In the most recent issue of the *Simmons Review*, I noted that a gift had been given to Simmons in memory of **Mark Hamburger**, husband of Lucille Forman Hamburger, Simmons, '33. Your secretary used to see Mark at Simmons when attending reunions with Betty.

A note from **Donald Lyman** of St. Petersburg, Fla., sent to the alumni office, says in part "I think we were the first class to enter the new buildings given by the mysterious Mr. Smith. For three years after graduation I worked for Western Electric. Then I went to the company founded by Mr. Smith (Eastman Kodak) and spent 40 interesting years in development and engineering work."

Late in March **Bob Miller** told me about plans to fly to Houston with his daughter Josephine to

visit another daughter Kathleen. From Houston they will fly to Los Angeles, where Bob is planning to phone Sam Lunden and perhaps have lunch with him. On April 6 they board the QE2, which stops at Acapulco, then through the Panama Canal to Caragena, Kingston, Jamaica, and finally to Fort Lauderdale—13 days on ship. It sounds grand!

Sadly I report two deaths this month. **Robert E. Travis** of Hinsdale, Ill., died on November 6, 1985. I am indebted to Yardley Chittick, secretary of the class of 1922, for news of the death of **Miles Zoller** of Tequesta, Fla. on February 21, 1986. Yard writes, "During our M.I.T. years at the fraternity house, I always looked up to and had the highest regard for Miles." Our sympathy goes out to the families of these two classmates.—**Sumner Hayward**, Secretary, Wellspring House E64, Washington Ave. Ext., Albany, NY 12203; **Samuel E. Lunden**, Assistant Secretary, 6205 Via Colinita, Rancho Palos Verdes, CA 90274

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Our class president, **Parke Appel**, at a recent meeting of the Southwest Florida M.I.T. Club received a formal testimonial in appreciation of his long time service as president of the club; another indication of Parke's unending interest in Institute-related affairs.

At our 35th reunion in 1957, each attendant received a memento in the form of a Zippo lighter. Mine, never used, was sent to the M.I.T. Museum last March with the thought that it might give some indication of the prevalence of smoking by '22ers only 29 years ago. No word from the Museum as of this writing on whether they want it.

Last February, **Martha Eisman Munzer** was given an award for journalism by the Broward County chapter of the Florida Engineering Society for the article she wrote on "Ecological Illiterates" that appeared as a feature in the *Fort Lauderdale News and Sun Sentinel*. Also another article by Martha, "A French Student at MIT—circa 1920," was recently published in the magazine *U.S. Woman Engineer*. On the down side we regret to learn that Martha's husband, Corky, died suddenly on February 8th in his 89th year.

Classmate **Ed Keene**, a retired partner of Fay, Spofford & Thorndike sent me the following account of the career of **William L. Hyland** who died February 16, 1986, at age 85. "William L. Hyland received an S.B. degree in mechanical engineering from M.I.T. in 1922. After four years experience in design and construction of hydro-electric plants and sewer and drainage systems, he joined Fay, Spofford & Thorndike in 1926. From 1926 to 1947, his experience included all phases of office and field engineering on a wide variety of projects, largely water supply and sewage in the United States, Canada, Labrador, Baffin Island and Greenland. Mr. Hyland became a partner of Fay, Spofford & Thorndike in 1947 and a vice-president in 1956. As a principal member of the firm, he functioned as project manager on a wide variety of engineering projects ranging in value from a few hundred thousand to over two hundred million dollars. Mr. Hyland was registered to practice as a professional engineer in Massachusetts, New Hampshire, Connecticut, New York, North Carolina and Alaska. He was a member of the following organizations: Boston Society of Civil Engineers (past president); American Institute of Consulting Engineers; American Society of Mechanical Engineers (member of incinerating committee); American Society of Civil Engineers (Fellow); Massachusetts Society of Professional Engineers; American Academy of Environmental Engineers, Diplomat; and Consulting Engineers Council, New England Division (past president)." Ed added, "Bill Hyland was an able and productive engineer, a rock of integrity and a master of the art of being a human being. I think he was the most widely liked and respected person I ever knew." Bill is survived by a sister, two

daughters and eight grandchildren.

Fearing Pratt, retired from the telephone company for many years, died February 27, 1986, at age 88. At M.I.T., he was a member of Phi Beta Epsilon, Masque, Electrical Engineering Society, Radio Society, Rifle Club, freshman tug of war team, assistant manager of Tech Show as a freshman and sophomore, business manager as a junior and assistant to the general manager as a senior. Fearing was an enthusiastic skier and he stopped now and then to call on us while on his way to or from the ski slopes. He was a regular attendant at Alumni Day until his incapacitation two years ago. . . . **Harold Nelson Loomer**, Course II, died December 10, 1985, in Dunedin, Fla., where he had lived for many years. He had been a member of the M.I.T. Club of Tampa Bay, no other details about his work or family are available. Our regrets on the passing of these classmates.—**Yardley Chittick**, Secretary, Box 390, Ossipee, NH 03864

23

Alice Kimball, '36, has sent a clipping from the *Hartford Courant* telling of the death of **Joseph Chaffee** on February 25, 1986. He graduated in electrical engineering and became a member of the technical staff of the Bell Telephone Laboratory for over 40 years. He had a number of inventions in the radio communications field. In 1954 he was elected a fellow of the IEEE.

Robert Canby died in May 1984. He graduated in engineering and business administration and was vice-president of the William S. Scull Company of Dayton, Ohio. We have no other information about his career.

Albert Gordon died September 26, 1985. He attended Worcester Polytechnical Institute, entered M.I.T. in 1920 and earned a degree in electrical engineering. Upon graduation he joined Crompton and Knowles Corp. in Worcester where he remained until retirement in 1965. During those years he worked in the laboratory and in sales engineering and was foreman of maintenance. After the World War II years he remained in manufacturing and acquired the title of manager of manufacturing engineering. He belonged to the Worcester Country Club, Tatnuck Country Club, Quinsigamond Boat Club, University Club, M.I.T. Club, and the Worcester Club. He was a member also of Old Sturbridge Village and the Worcester Horticultural Society of which he was a Trustee. As a resident of the nearby town of Paxton, he became a member and chairman of the finance committee and also was appointed to the personnel advisory board. Upon retiring to South Yarmouth on Cape Cod he became active in the Dennis Forum, the Orleans Coffee Club, and the Mid-Cape Men's Club. He was a member of the Unitarian Church of Barnstable and the Mayflower Society. His hobby was woodworking.

Jacob Elfenbein died November 15, 1985. He received his masters degree in aeronautical engineering in 1923. We have no information about his professional career.

Charles Schell died on September 15, 1985. He received his degree in chemical engineering. After graduating he was employed by the Armstrong Cork Co. and became supervising chemist at the Braintree plant, retiring after 44 years of service. He was parish clerk of the Emmanuel Episcopal Church for many years. His hobbies were philately, and photography of ships and light houses.—**Richard H. Frazier**, Secretary/Treasurer, 7 Summit Ave., Winchester, MA 01890

24

We non-travellers depend on our classmates for up-to-date, authentic, descriptive information on world locations. One of these nomads is **Dick Shea** who in February left Florida, ostensibly to attend a meeting in La Jolla, Calif., of the Nuclear and Plasma Sciences Society Administrative Com-

mittee. However, he was shanghaied by a boat to Honolulu and the islands, where he visited the awe-inspiring Haleakala Crater, so large that it could contain the island of Manhattan, buffeted by wind and cold at la Mt. Washington; the Waimea Canyon, "Grand Canyon of the Pacific," and a river trip to the Fern Grotto with lush foliage, definitely one of the beauty spots of the voyage. On his return he had to brush up on his golf via Escondido at the Lawrence Welk Village Inn, before getting down to business at the La Jolla meeting. His gambling hopes in Tijuana turned into a disaster and he waded back through Mexican poverty, until reaching the good old U.S.A.

Martin J. Buerger died February 25, 1986, of Alzheimer's disease at his home in Lincoln, Mass. He was a retired Institute Professor, and professor of mineralogy and crystallography and had been associated with M.I.T. for 55 years when he closed out his career in 1975. He was awarded his S.B., S.M. and Ph.D. before graduate work in the Department of Geology, marking the beginning of his distinguished career.

Martin was renowned for his pioneer work in the application of x-ray crystallography and internationally known for his instruments, analytical methods, research publications and the young scientists trained under his direction. He was president or vice-president of many scientific societies and a member of the American Academy of Arts and Sciences. He published two books and about 100 scientific papers.

You should be receiving a letter from **Don Moore**, requiring study, judgment and an important reply.—**Russ Ambach**, Secretary, 216 St. Paul St., Brookline, MA 02146

25

One of the recipients of the Harold E. Lobdell Distinguished Service Awards at the last National Alumni Conference was our class agent, **Ed McLaughlin**, who was singled out for his long time service to the Alumni Fund. . . . **Stanley Lane** came down from Maine to visit his brother Norman, class of 1929, in South Yarmouth, Mass., in February just in time to attend the Cape Cod Club winter meeting. It provided a fine opportunity to reminisce. . . . **Arch Nickerson** sends greetings to the class stating he is enjoying life one day at a time in Duxbury, Mass., summer resort near the Pilgrim's Plimoth Plantation. He has at least 11 Mayflower ancestors. His family now includes a second great-granddaughter, born in December 1985.

Millard Caldwell writes from Sonoma, Calif. and informs us of his present activity. He has been trying to persuade Congress and the president not to exclude social security from the items which can be reduced to help balance the budget by 1990. Millard is concerned that cost-of-living adjustments may help the needy but also benefit those who do not need help and feeds inflation. He hopes others will help him in his work to remove "this burden on our descendants."

A letter from Charlotte Blonsky brings the sad news that **George (Count) Blonsky** died of heart failure at his home in San Jose, Calif., on December 2, 1985, his 84th birthday. George, of Russian birth, came from Moukden, China, to the Institute to study mining engineering. Throughout his career George worked in mining or associated fields. After graduation he went to Alaska with the U.S.S.R. & M. Co. In the early 1930s he spent several years in Europe with the Dorr Co. While in Germany he met and married Charlotte. He then worked out of the Los Angeles area for a number of years and spent many week-ends prospecting. In the middle 1950s he reopened and operated the Worthree Mines near Kingman, Ariz. Finally he moved to the New York City area and continued to live there when he retired. After 25 years in New York he moved to San Jose to be nearer to some of his relatives.

We have lost another classmate who was born

in Russia. **Constantine Zakhachenko**, an aeronautical engineer, died on September 30, 1985, at the George Washington University Hospital in Washington, D.C., after a heart attack. Before coming to this country in the early 1920s he attended the Imperial Russian Naval Academy and served in the Tsarist navy in World War I. He obtained his masters degree at the Institute in 1925 after which he worked for several aircraft companies and was a consultant to the government of China before joining the National Bureau of Standards in 1949. He was an official of the U.S. Navy's Bureau of Ordnance from 1950 to 1956. He spent the next 20 years as a consultant to both government and private organizations. He was a recipient of the U.S. Navy's Distinguished Civilian Service Award.

Professor **Martin J. Buerger**, known to many classmates, passed away at his home in Lincoln, Mass., on February 25, 1986. Although Martin graduated in 1925 he chose to be considered a member of the class of 1924. For that reason it is left to 1924 to write up his obituary. However, since he was a retired member of the M.I.T. faculty a complete obituary will probably appear in the *Review* before you read these notes.—**F. Leroy (Doc) Foster**, Secretary, 434 Old Comers Rd., P.O. Box 331, North Chatham, MA 02650

26

Correction: Contrary to the caption on page MIT 31 of the April issue of the *Review*, **Russ Meyer** and is still living in Kirkwood, Mo.

Due to some eye problems (glaucoma and cataracts), your secretary, **William Meehan**, will not be writing this column for the next few issues. We wish him well and hope he will be able to continue as secretary after surgery. In the meantime, he hopes that the class biography (which you should have received by now) will serve to keep classmates updated about one another.—**ed.** (**William Meehan**, Secretary, 191 Doreset Rd., Waban, MA 02168)

27

Percy L. Richardson, whose homes had been in Venice, Fla., and Andover, N.H., died on February 3, 1986. He suffered a stroke in June of 1984 and moved to be near his daughter, Lydia Bates in Ann Arbor, Mich. Her husband Brad is M.I.T. '59.

"Rich" was course XV and started with Con Edison of N.Y. until 1936, then until 1944 was employed as electric rate engineer at Ebasco Services Inc., in New York City. He then worked for DuPont in Newark, Del., and Wilmington, first as a utility service consultant and later in their purchasing department. He retired in 1966 having become purchasing agent in utility services.

Daughter Lydia, a Wellesley '60 graduate, writes: "My father always held M.I.T. in high regard and was no doubt pleased when I married a Tech man. Up to the time of his stroke, my father had enjoyed remarkably good health and a vigorous life. He was known for his clippings of articles from newspapers which he sent on to his many correspondents. One thing his friends have repeatedly commented on is how much they miss his wonderful letters. He even used to send a fresh tea bag and tell his friends to make a cup of tea before they sat down to read the letter; just like having a cozy chat across the miles. Most of all he just enjoyed meeting new people. He occasionally would visit me at my work and after sitting in the waiting room, would shortly know the life history of everyone there!"

What a fine tribute and we wish we had known him. He is distinguished by making a bequest of \$5,000 to M.I.T. with a request of a plaque on a 10-250 Chair. What a great classmate personality who never attended a reunion.

How many others of you have made a bequest to M.I.T.?—**Joseph C. Budley**, Secretary, RFD #3,

Epping, NH 03042; **Lawrence B. Grew**, Assistant Secretary, 21 Yawag Ave., Branford, CT 06405; **Prentiss I. Cole**, Assistant Secretary, 2150 Webster St., Palo Alto, CA 94301

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George Palo and **Jim Donovan** are two of the best corresponding links with the class and so do very well as field reporters. We are grateful for their very effective help. At this time we are most happy to report that Frannie Donovan is making a good recovery from her recent knee surgery. It has been a long and uncomfortable experience for her but, as of this writing (early April), she is planning to accompany Jim to a local social evening and dinner.

A bit conceited perhaps, but we have always suspected that ours is a particularly lively class and occasionally we have some evidence of it. Such is a letter from **Al Gracia** written in late February. Al spent February on a Caribbean cruise, returned home for his annual health checkups, and was planning an April visit to relatives and friends in North Carolina and Maryland. For May he planned to go back to Akron, Ohio (his home for 42 years) and visit with old friends. June was scheduled to include an Elderhostel session at Amherst, Mass., then on to the family camp at Lake Cabbosettee in Maine. In the fall he expects to go to Luxembourg and Germany to visit European friends. Al's health is good, and he loves to travel.

Another vigorous classmate is **Walter Matlage**. Since his retirement from DuPont in 1969, Matt and his wife have traveled worldwide. Now they have settled down on Key Biscayne and plan to stay put. However, this does not mean inaction, for Matt says: "In an effort to keep in reasonably good condition, I have become an avid but very poor golfer. With several friends, I tee off every morning at daybreak to play 18 holes. I play with three people weekdays and three others on Saturday and Sunday. The early start minimizes sun exposure. As opposed to the good golfer who can't forget his occasional bad shot, I always remember my good shots. Consequently I have much more fun."

A letter from **Betty and Dud Smith** tells us that he has been having bronchial trouble since their trip to Alaska last year. However, they hope that a trip to Honolulu for a family reunion will be helpful. On March 1 of this year, Dud and Betty celebrated their 56th wedding anniversary. Our sincere congratulations and very good wishes!

From **Edward Petzold** we have this note: "Assisting my young wife with her real estate activities. We are going together to the French Riviera and Paris in March-April. Then looking forward to a nice spring in beautiful Marion, Mass." . . . We are sorry to learn that **Bill Grunwell** suffered a heart attack: this happened while he was sailing on the Mississippi River.

Kathern Hazen tells us: "I fill my time and devote most of my expendable energy to doing volunteer work for a small non-profit organization called the American Association of Variable Star Observers. (This name throws most of my friends for a loop, you may be sure.) One does not need to be an astronomer to be able to do some of the routine work in the office, and in addition I believe I have helped them with their first feeble attempts at fund-raising. I do enjoy it."—**Walter J. Smith**, Secretary, 37 Dix St., Winchester, MA 01890

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I have a note from **Jackson Emery** of Norristown, Pa. as follows: "I am happy to report that I have four grandchildren in college—Amherst, Harvard, Lock Haven (Pa.), and Bloomberg (Pa.). Another grandchild will be in college in two years. I see from the fall newsletter of *Friends of M.I.T.* Crew that many of the crew members whom I knew are

still with us. I was a member of the 1927 freshman crew but was out of school for two years so that I graduated in 1929. Best wishes to all." . . . Professor **Fred S. Eastman** of Medford, Ore., sends a brief note saying, "We have now lived in this wonderful retirement place for more than a year, and we like it very much." He and his wife Louise enjoy hiking, lawn bowling and prowling by car. They have two children and three grandchildren. . . . **Mirko Paneyko** of Easton, Conn., is still fully active as president and chief engineer of MP Audio Corp. His hobbies include tennis and boating. He and his wife Roberta have two children. . . . **Richard Pies** of San Mateo, Calif., writes, "My sister Beatrice is still in a convalescent hospital, and I spend time with her each day, as life in such facilities is not easy. As for me, I have no real complaints, as friends and neighbors are most helpful." Richard attended our 40th reunion with his two sisters, one of whom passed away a few years ago.

Charles W. Sampson of Rochester, N.Y., writes, "We have been recently blessed with a new great granddaughter by our eldest grandson. We are enjoying life to the fullest." . . . **Arthur Bearce** of Punta Gorda, Fla., and Gloucester, Mass., writes, "I would like to leave Florida by the end of May, in time to attend Technology Day in June and see **Put Cilley** and you. This might be the last year for me. Oranges and lemons are ripe in our backyard, and we have fresh juices for breakfast. I gave away a bushel of lemons we couldn't use. Best regards to all." . . . **Harold M. Weddle** of San Diego, Calif., says, "We enjoy life one day at a time as much as ever. Best regards to all."

James C. Reddig of Webster, N.Y., writes, "I try to get about to air shows and visit museums associated with the aircraft industry and view the collections. I was at Oshkosh last August to see and hear the Concorde making a touch-and-go landing right close in front of the crowd. I crossed on the Concorde in 1977 and the inside was well insulated from the noise. Oshkosh let it all hang out—very impressive. British Airways sold 25-minute rides around the pea patch for \$400, and every available seat was sold out. I am now snuggled in behind my books and papers and will soon be returning to read and explore the archives of the National Air and Space Museum. I also plan to go see **Paul Baker** in Williamsburg, Va. I am really looking forward to the demonstration this spring of De McCready's half-size model of flapping-wing flight—an ornithopter, which first flew on January 8, 1986, under radio control in Mojave. My thanks and best wishes to all the gang." Jim has three children and seven grandchildren. Under hobbies, he lists, appropriately, "chasing airplanes."

I regret to announce the death of two of our classmates, **William W. Young, Jr.** of Old Saybrook, Conn., on December 7, 1985, and **Robert A. Sykes** of Largo, Fla., on February 16, 1986. In response to my birthday card sent to Bill, I received a note from his daughter, Mrs. Priscilla Loveridge, that her dad had passed away. He was an industrial engineer for Connecticut Light and Power Co., Waterbury, Conn., from 1929 to 1937; president of W. Wirt Young and Associates, Waterbury, Boston, and Philadelphia, from 1939 to 1957; consultant for Connecticut Natural Gas Corp., Hartford, Conn. from 1957 to 1962; and president of New Haven Heat Treating Co. from 1962 to 1972. He lost his wife Jane to cancer a few years ago. The Youngs attended most of our major reunions including the 50th. . . . I received a note from **Dexter Osgood** of Malverne, N.Y., our class agent, informing me of the death of his close friend **Roger Sykes**. Dexter states that he and Roger were in Course VI-A together, and after graduation they both ended up working for Bell Telephone Laboratories. He was a native of Windsor, Vt., and was a ham radio operator in those days. While at Bell Lab, he was put in charge of a group that was working on the design and application of crystals. He was assigned to the Allentown Lab and retired from there in 1968

after 39 years of service. He is survived by his wife Mary. They attended our 40th reunion at the Wianno Club at the Cape.—**Karnig S. Dinjian**, Secretary, P.O. Box 83, Arlington, MA 02174

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Supplementing last month's report on the Career Development Professorship established by the Latham family, it appears that early this year some 17 members of **Jack Latham's** family had a reunion in Barbados. Jack played golf with his daughter Harriett, his first golf game since he and I played together in the early 1930s in Charleston, W. Va., where we then worked and roomed together. Jack is currently enthusiastic about a "radically new centrifuge" that he has been "working on for a long time" and that, at the time he wrote, was due for a "very critical trial." . . . **W.E. (Bill) Cullinan** has retired after holding several airport management jobs, including manager of the Logan airport near Boston. He is apparently an exceptionally good golfer. In 1984 he played in a PGA senior Pro-Am tournament at the Purpoodoc Club (Maine) with the Australian pro Peter Thompson and their group came in first. His handicap is 13. Judging by the golf I saw played at the last two reunions, I suspect that Bill may be our No. 1 golfer. . . . **Ted Riehl** reports the receipt of a long letter from **Ralph Rowzee** who has now "finally completely retired" and is "living the quiet life in Sarnia, Ontario." At the time of Ted's report, **Jack Bennett** was about to have a second hip replaced, but we have no news as to how he fared. Margaret and Ted were scheduled for a spring cruise from Ft. Lauderdale to Greece, followed by a week in Germany before heading home.

Frank Burley is professor emeritus of the Purdue School of Engineering and Technology in Indianapolis, where he taught for a number of years after retiring from Western Electric. He still teaches a "booster" class three days a week aimed at cutting down drop-outs and failures. About a year ago Frank received a Distinguished Professor Award. His daughter and her family now live in The Hague, where Frank has visited several times. . . . Frank's report on his teaching activities has stimulated me to mention my own very modest efforts in this area. As most of you know, although Louise and I are residents of Southbury, Conn., as indicated below, we spend our winters in Green Valley, Ariz., a Tucson exurb peopled largely by retirees. The few teenagers in Green Valley attended a regional high school at Sahuarita, AZ a few miles north of Green Valley, and a couple of months ago I started spending a few hours a week there as a teacher's aide to the physics instructor. This involves coaching students who have missed classes because of illness, correcting quiz papers and chatting with youngsters about their experiments during "lab" sessions. Also, having been involved in the Manhattan Project research on diffusion separation during World War II, I was able to work up a short talk on the way in which the kinetic gas theory, which the class was then studying, was used at Oak Ridge to separate the uranium isotopes. I may say that a considerable amount of satisfaction can be derived from embarking on such a new project, especially at our advanced age.

We have at hand a sad note from **Kathleen McKenna** telling of Frank's death on December 28, 1985, after a long illness. He apparently had a series of brain-damaging strokes that severely impaired his ability to communicate and consigned him to a nursing home, where Kathleen visited him daily for four years. Frank was a construction engineer who played a significant role in the construction of the Empire State Building and the Argonne National Laboratory. Prior to his retirement in 1972 he had worked as a construction engineer for **Darin & Armstrong** in Detroit for about ten years. After his retirement he moved to Spring Lake, N.J., with his first wife Marion, who

died in 1976. He married Kathleen several years later. Before his illness his activities included fishing, hunting, golfing and ham radio operations. In addition to Kathleen, Frank is survived by two sons: **Frank Jr.** of Cleveland and **Charles** of Wheaton, Ill.; a daughter **Susan Weis** of Wheaton and six grandchildren. . . . We have also received a notice that **Clinton Burns** died in June 1985, but unfortunately I have little information about him. As of 20 years ago he was working as a mechanical engineer with the National Institutes of Health in Bethesda, Md., where he was living at the time of his death.—**Gordon K. Lister**, Secretary, 294-B Heritage Village, Southbury, CT 06488

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Alexander Kuhnel writes to the Alumni Association as follows: "Retired since January 1974, and I am currently Redwood Empire Mathcounts Coordinator for California Society of Professional Engineers as well as coach of Santa Rosa Jr. High School Mathcounts Team, and Volunteer Math Tutor for Upper Elementary Jr. High School and High School students in Santa Rosa public schools."

By the time these notes are published you should have received the information regarding our 55th Reunion. In case it hasn't been received, please drop a note to **Ben Steverman**, Chairman of the Reunion Committee, whose address is 2 Pawtucket Rd., Plymouth, MA 02360.

Unfortunately, the only other news reported by our Alumni Association is "sad news" concerning the deaths of the following classmates. **Carl F. Baker**, retired vice-president of Chandler Evans Division of Colt Industries, passed away in Hendersonville, N.C., on December 16, 1985. Carl went to Hartford in 1933 to join the engineering department of Hamilton Standard Propeller Division of United Aircraft Corp. in Windsor Locks, Conn. He became assistant engineer of the division in 1936 and its chief engineer in 1944. He later joined Chandler Evans where he became quality manager for the company. In 1962, he was named vice-president of the West Hartford company where he worked for several years before retiring in the early 1970s. He lived in West Hartford for many years and was a member of the Farmington Country Club. After retiring, he moved to Cape Cod, Mass., where he lived for several years before moving to North Carolina.

. . . **Harry Soden** passed away on January 5, 1986. He lived at 1148 Beal St., Rocky Mount, NC 27801. No further information has been received.

Herbert F. Hiller died on October 31, 1985. His address was 11 Beechwood Rd., Verona, NJ 07044. No further information has been given to me concerning his activities after graduation from M.I.T.

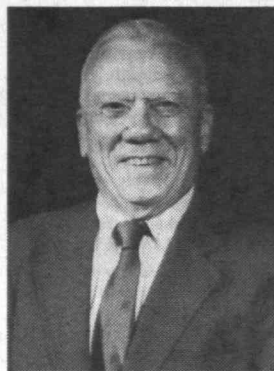
Deaths of two of our classmates's wives were also reported, namely, **Mrs. Francis C. Crotty** who passed away on May 20, 1984 and whose address was 5209 31st Rd., Arlington, VA 22207; and **Janet P. Barnard**, who was very active in Wellesley organizations. For 12 years, in the 1950s and 1960s, **Mrs. Barnard** was executive secretary of the town of Wellesley's personnel board. She was born in Oakland, Calif., daughter of **George A.** and **Helen M. (Simpson) Boomer** and grew up in Waterbury, Conn. **Mrs. Barnard** was graduated from St. Margaret's Episcopal School, Waterbury, Conn., and was graduated magna cum laude from Connecticut College for Women, now Connecticut College. After graduation she was secretary for graduate affairs at the college and later she worked for several years for the board of admissions at Yale University. She leaves, **Larry Barnard**, our classmate.

Your assistant secretary, **Ben Steverman**, says, "My wife, **Ellamae** died March 2, 1985, while on vacation at Cru Bay, St. John. I am keeping busy with R.S.V.P.s Think Tank and my lectures list now comprises 20 different subjects, including slides **Harold Edgerton**, '27, loaned me. I gave about 60 lectures a year covering science, history,

and travel and have also been on panels at Rutgers University and others about retirement planning."

Our sincerest condolences to the families of the above.—**Edwin S. Worden**, Secretary, P.O. Box 1241, Mount Dora, FL 32757; **John Swanton**, Assistant Secretary, 27 George St., Newton, MA 02158; **Ben Steverman**, Assistant Secretary, 2 Pawtucket Rd., Plymouth, MA 02360

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L. W. "Bill" Glowa, '32

We were pleased to learn that our classmate **Latimer W. Glowa** received the Prestigious Pioneer Award from the Association of Old Crows. The citation gave particular significance to his successful effort in leading U.S. government and military services to accept one time standard for national use. Also, in one year **Latimer (Bill)** hosted 30 technology seminars attended by over 2,400 personnel while obtaining 6,258 independent research and development project descriptions from 235 research centers. He had accrued 44 years of military and federal electronic-warfare-associated service.

Springfield, Mass. honored our **Arthur Marshall**. The following telegram was sent on April 1 to the dinner gathering. "Your classmates of M.I.T. join me in congratulating you for receiving the Humanitarian Award and wish you many more years of constructive activity." . . . **Winston B. Braxton** writes that he is younger than **Wendell Bearce**, as his birthday was August 24, 1912. He thinks there is one classmate younger than he by about two months. He still is busy building trails for the Fingerlake Trail Conference and other civic activities.

Minot R. Bridgman writes, "Over 30 years ago the Old Guard of White Plains was organized and has met weekly ever since. I count myself fortunate to be a member and enjoy the fellowship of the 200 retired business and professional men in it. It is truly a life-extender and the focus of much of my activity. Besides weekly presentations, there is also bridge, golf, bowling, and more. God willing, Norma and I are planning to drive to the coast and back—about a 45-day trip.

Dolph Warsher writes most interestingly. Let me excerpt the highlights. "The names of **Jim Ritchey**, **Bob Prescott**, **Carl Wahlstrom**, **Tom Smith**, and **Carl Bunker** all sparked recall of undergraduate memories. A classmate in Course VI-C who worked at the Rad Lab and then had his own postwar business was **Eddie Richmond Levine**. A great sculler, he kept his own single at the St. Alphonsus Boat Club on the Charles, and it is still there three years after his death! He left a wife and three fine children. . . . Another VI-C, classmate who worked himself into an early retirement and the 'grave' was **Joseph T. Cimorelli**. Except for a short stint with **Lionel Corp.**, he spent his whole professional life with **RCA**. He left a wife, **Mary**, and two fine children. . . . I am 11 years now at **Draper Laboratory** and full time

in the FBM submarine missile program."

Wyman P. Boynton, '31, writes us that his good friend **Philip T. Boothby** died on March 17, 1986. Phil was employed as a chief engineer of a design division of the Portsmouth Naval Shipyard, where he worked for 35 years. In 1973 he moved to North Conway. He was active in civic, religious, and professional organizations. He is survived by his wife Luella, two daughters, and three grandchildren.—**Melvin Castleman**, Secretary, 163 Beach Bluff Ave., Swampscott, MA 01907

33

Your secretary had a lot of mail back near New Years, including many Christmas greetings. Thanks to all of you. Much of the news this month came then, so many items are rather old; just keep the information flowing. I suggest that when you receive a letter from a classmate you make a copy for me, or capsule it, and send it on.

Dick Morse, our class president, was back in Wellesley during the Easter holiday and reports news from **Niazi Mostafa**—they are coming to the 55th. . . . A note about **Cy Hapgood** says he is still working with his patent law firm which now has 92 lawyers. The Morses and Hapgoods see each other when they are both in DelRay Beach. . . . News from the Alumni Office tells us of the death of **Draveaux Bender**, one of our architects who worked in the field of city planning in the Cambridge area.

The **Joel Stevenses** spent a vacation at St. Simons Island. Who has heard from **Westy Westaway**? **Stan Walters** has moved back to East Sullivan, N.H. 03445 (Apple Hill Rd.) from Keene, N.H. In mid-winter he was riding through the woods spotting trees to be removed as firewood next fall. Some of our folks are trying solar heat; Stan uses a wood-fired system. He is winding down the manufacturers' rep business as his son takes over. He flew to Venice, Fla., and met part of a wedding party he attended 50 years ago. He plays viola with a community chamber music orchestra which recorded a Mozart piano concerto. Stan has his office in a remodeled barn.

. . . **Dayton Clewell** went to visit one of his daughters on the west coast at year's end.

I offered to send addresses to anyone who wants to write a classmate. Lo and behold **Adolph Warsher** who lives in Brookline was the first to use the service! He wanted **Horace Mackenzie's** address. It went out to him promptly. Warsher consults with the Draper Lab in Cambridge finishing 11 years of the association. Mackenzie has a busy retirement and still plans to move to a Harvard, Pa., retirement home this fall.

. . . **Al Mayer** should be writing again soon. . . . **Jack Frost** and **Jermain** travel a lot to many places, including visits to grandchildren in California. . . . **Charles Macmillan** received a 50-year recognition pin from the Society of Automotive Engineers. Where did you spend those 50 years, Charlie? . . . **Bob Dillon** and **Alice** had a trip to Rio and Brasilia for spring.

John Longley says it is only two years till our 55th and they confidently expect to make it. Lil does painting and will have a one-woman show on Cape Cod this summer. He bought a cross-country ski outfit back when there was snow on the ground. . . . **John C. King**, course I, consults on concrete restoration problems and had an assignment at a nuclear power plant in Korea last year, sort of a combination hobby and work. . . . Xmas card from the **Fred Murphys**, now it's time for a letter. . . . **George Stoll** repairs Gravely garden tractors as a hobby and calls my attention to the fact that they are a Carolina product. . . . **Walter Skees** has an estate in Nassau for sale.

. . . **Berj Tashjian** sent a Christmas greeting self-designed. What else is new with you that I can pass along next month?—**Beaumont Whitton**, Secretary, Cottage 112, Sharon Towers, 5150 Sharon Rd., Charlotte, NC 28210

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In the last issue I mentioned the loss of **Connie Chase** but had no additional information. Since then I have had some more. He had been living in a nursing home in Paoli, Pa., presumably because one son lives in the Philadelphia area. Additionally, **Connie** left another son in the Canal Zone, a daughter in North Carolina, and a brother in Portsmouth, Va. There are also five grandchildren.

There are, unfortunately, two more losses to report, one from a distant alumnus. On January 27, 1985, **Edward Bateman** died in Sandton, South Africa. He is survived by his widow. . . . From his son, we learn that **Harold A. Butters** of Winchester, Mass., passed away on June 30, 1985. I offer both families our condolences on their losses.

Only one Alumni Fund note this time: **John Newbegin** writes, "Sold our house in Easton last July. Put an addition on our home at the lake. Also put on a new roof and added a cellar floor and a hot water heating system. Proceeded with a lot of insulation, and we are now very comfortable. Still have a lot of finishing in the bedrooms. I have been too busy so far to do any skiing but will get to it soon. I neglected to tell the Alumni Association about my permanent move to Champlain, so have missed the *Review* since October."

I'm just back from my trip to Florida and the Everglades. This was fun. Among other things, we saw a crocodile (there are only 200-300 left in the U.S.) and got a good look at Halley's Comet. Down there the nighttime ambient light level is so low you could see it with the naked eye, and a good pair of 7x50 bionoculars were even better than a low-power astronomical telescope. The week there coincided with the Boston area having about the coldest weather of the winter—you don't wish the stay-at-homes ill but you hate to go that far and then find you'd have been better at home. Florida turned the tables before I left: the last week was cool, windy, and lots of rain.—**Robert M. Franklin**, Secretary, P.O. Box 1147 (620 Satucket Rd.), Brewster, MA 02631; **George G. Bull**, Assistant Secretary, The Elizabeth, 4601 N. Park Ave., Apt. 711, Chevy Chase, MD 20815

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The number six man of our reunion crew, **Walter Stockmayer**, sent me a card "MIT LUFTPOST" from Mainz, W. Germany: "Greetings from the Rhine. Saw a four out several days ago (as in rowing). Am here on a short trip without Sylvia, talking at several scientific meetings. Hope things are going well for you." With the beautiful Spring weather we have been having, it is difficult not to see a very busy Charles River dotted with oarsmen and women in singles, doubles, fours and eights. Most are getting ready for the college and club races which have been going since late March. M.I.T. is racing Columbia today April 5th. If I were a full-blown retiree, I would be out there in a single daily in between rounds of golf! In '39 I won the New England Singles Scull Championship while rowing for the Union Boat Club—the high point of my rowing career!

Here's a brief note from **Morton Hecht, Jr.** through the Alumni Office: "I'm a retired dermatologist living on California real estate, but how I'd like to go again on a Technological Toot!"

The ending of our Class Golf after 25 years last year has cut down my notes material. Not only were they all great golfers but they were superb letter-writers. With that accolade, maybe my mail will pick up for the next issue.

I do have news but it is not the kind I enjoy writing about. **Robert W. Forster** died early Monday morning, March 31 in the Newton-Wellesley Hospital after a brief illness. The class lost a man who had contributed much of his free time up until the last few years in class activities. He was our class president for a term and chairman of

our reunions, several times, and active in all our class affairs. I lost a good friend and golf partner and in my happier days he and **Connie** were frequent foursome members with my wife and me. He played in the Class Golf until he injured his back a few years ago. **Bob** retired in 1976 after 36 years with Honeywell, of which 20 years was spent as branch manager of the Boston Sales Office. He spent several years in Brussels and Stockholm as consultant to Honeywell International. I was able personally to extend my classmates' sympathy to **Connie** and her four sons.

There are two other '35ers deaths to report to you: **Malcolm A. Porter** whose widow **Betty** wrote from their home in Hagerstown, Md., of his death December 28, 1985; and **Randolph L. Strickland** who died at Vero Beach, Fla., on July 22, 1985.—**Allan Q. Mowatt**, Secretary, P.O. Box 524, Waltham, MA 02254

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50th Reunion

These notes are due two months before our 50th Reunion and are being read by you after that event. I do not want to detail all that it is hoped will happen but I have received notes in connection with reunion planning and I will share some of the gleanings with you here. . . . **Henry McGrath** wrote that while he and **Mildred** were away, their home in Great Falls, Va., burned to the ground! . . . **Dick DeWolfe** writes that in the summer of 1982 he got up enough courage to go on a bicycle trip in China. He liked it so much that he went again the next year and preceding the bike tour he toured with the William Hall Chorale. He went with the WHC to Scandinavia and Russia in 1985 and hopes to go with them in 1987 to Australia and New Zealand. . . . Even as I write **Laddie Reday** is trekking in the Himalayas with Sir Edmund Hillary. He hoped he and **Peg** would be able to "hack" it. . . . President **Tony Hittl** and **Dottie** are on a tour of New Zealand and Australia. . . . When you read this all of the above mentioned will have given us personal accounts at the reunion.

I had a note from **Ruth Haynes** telling of the death of her husband, **Robert M. Haynes**, on February 15, 1985. He worked for U.S. Steel in Boston for several years and then managed the John L. Fowle factory in Woburn, Mass. He retired early and devoted the 21 years of his retirement to conservation work with the Sierra Club, Nature Conservancy and most of all the National Audubon Society. He served as a president of three chapters of this last, having founded one, bringing it to national award-winning status before it was a year old. He and **Ruth** travelled the country by motor home studying wilderness areas and endeavoring to find ways to preserve those wonders for future generations. Besides **Ruth**, **Bob** is survived by two sons. **Ruth**, at this writing, is living at 110 N. Tremain St., Apt. 202, Mount Dora, FL 32757, but expects to have moved before these notes appear in print. Our sympathy goes out to her and her sons.—**Alice H. Kimball**, Secretary, P.O. Box 31, West Hartford, CT 06091

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Harry Corman, Box 1416, Crossett Hill Rd., Duxbury, VT 05676, is semi-retired and last employed by Dufresne Henry as a consultant. His hobbies are tennis, piloting, piano and "turning our Vermont vacation house into a permanent residence." Travels have been to Europe, Mexico, West Indies, Florida and California. Wife **June's** main interest is tennis. **Harry** included a note reading: "Thanks for happy birthday wishes, we are heading for Florida (Naples) for two months, will see **Sidney Mank** and **Al Wynot** on the way down, regards to all the guys and hope to see you at the big one." . . . **Dr. Martin Deutsch**, 43 Reservoir St., Cambridge, MA 02138, received the Rumford Premium at the Rumford Award Cere-

mony. As part of the November '85 Niels Bohr Symposium of the America Academy of Arts and Sciences, President Herman Feshbach presented Rumford Medals for 1985 to four distinguished physicists. Established in 1796 to recognize outstanding discoveries in the field of heat and light, the Rumford Premium is one of the oldest scientific prizes in the United States. The presentation by Bernard F. Burke, Chairman of the Academy's Rumford Committee reads, "Martin Deutsch of the Massachusetts Institute of Technology has created and detected another new atom, positronium. Positronium is, in a certain sense, the simplest hydrogen atom because it consists of a positive and a negative electron bound together in one system. It has the virtue of simplicity, which pleases theorists, but also the disadvantage of living a very brief time. Martin Deutsch is therefore to be congratulated for being quick enough to measure its properties."

Ernest Ferris, 146 Greenleaf, Oak Brook, Ill., retired in November 1983 as corporate vice-president, engineering, Spring Division, Borg Warner. He is semi-retired working as vice-president for Jainopro and Amer-Japan Trading Co. Ernest received the Borg Warner Certificate of Honor for "over 20 patents." His hobbies are golf, skiing, racquet ball, ping pong, photography, listening to classical music and membership in SAE. He has traveled throughout the world. His wife Alyce's main interests are children, travel, relatives and Palestine relief. Ernest writes that he is still in reasonably active contact with **Bob Brauer**, **Dom Cestoni**, **Ferd Ferrary**, **Mike Zinchuk**, **Ray McFee**, and **Bill Bakarian**. He is "looking forward to getting together with you all at the 50th the good Lord willing." . . . **Conover Fitch, Jr.**, 211 Willow Rd., Nahant, MA 01908, retired in 1984 from Perry, Dean, Rogers & Partners, Architects, Boston. He was a partner, then senior associate, and is now semi-retired as a self-employed architect with a small private practice. His nonwork activities are commissioner, Mass. Historical Commission; director, Historic Boston, Inc.; trustee, Boston Home, Inc.; member, board of governors, Gore Place Society; member, building committee, Trinity Church, Copley Sq., Boston; trustee, Nahant Public Library; member, real estate committee, Society for the Preservation of New England Antiquities (SPNEA); choir member, Trinity Church; men's chorus, Apollo Club of Boston. Travels in 1985 were to Greece and England. Wife Priscilla's main interests are music and horticulture. He says: "Seem to be busier that ever. Enjoying more time at home."

Robert C. Glancy, Jr., 41 Grandview Ave., White Plains, NY 10605, writes: "Carrie and I had a pleasant trip to Scandinavia and Leningrad last summer. I will be serving my fourth year as a volunteer income tax counselor this year. I'm learning to talk to my AT&T PC 6300 computer." . . . **Francis D. Houghton**, R.F.D. Havenside A2, Vineyard Haven, MA 02568, writes, "Since retiring from the New Hampshire Water Supply and Pollution Control Commission in June 1980 (after 11 years as chief chemist of the laboratory and as state pesticides surveillance scientist), and I have kept busy. Church work, chemical consulting (Vineyard Environmental Protection has a water laboratory which I have helped to establish), and my hobbies have managed to fill most of my time. We do a lot of walking for pleasure and exercise." . . . **Charles R. Kahn, Jr.**, 675 Navaho Trail, Franklin Lakes, NJ 07417, is president of Wyant Conditioning Corp. Charles writes that he "remarried November 24, 1985 to Catherine Bradley of Muskogee, Okla. Doing some miscellaneous jaunting to Nassau and St. Maarten along with a trip or two to Muskogee. Looking forward to retiring in about three years having acquired a new, young partner. Still in air conditioning contracting, installation and service."

On January 1, 1986, the Polaroid Corp. announced that **William J. McCune, Jr.**, had moved from chairman and chief executive officer to chairman. . . . **Allan I. Roshkind**, 848 Collier Ct., Marco Island, FL 33937, completely retired April

1979 as vice-president, general manager-information products, A.B. Dick Co. He is now president of Nautilus Condominium, Inc. Marco Island. Hobbies are golf, fishing, second guessing Mr. Reagan and matching wits with Dean Witter. Travels have been two great trips to China, in 1979 and 1985, several cruises and European wanderings. Wife Pat's (Nee Mary Elizabeth Patterson) main interests are golf, backgammon, bridge, sewing and country club activities. Allan writes, "I retired early (age 62) from 32 years at A.B. Dick Co. in Chicago after a coronary bypass operation in 1974 and a colon cancer resection 1978. Feel great! Wonderful life and people in this part of Florida. Only snow we've seen since I retired in 1979 was on a trip to Alaska (our nephew is a long-time resident of Fairbanks), and another Royal Viking ride to the North Cape of Norway."

. . . **Richard M. Westfall**, R.D. #2, Box 465, Phoenixville, PA 19460, retired September 1960 as superintendent of maintenance, Longwood Gardens, Kennett Square, Pa. His volunteer work is as trustee and treasurer of East Whiteland Cemetery Association, Frazer, Pa. Wife Juanita's main interests are home, family and grandchildren.

Albert S. Wynot, 15 Westdale Rd., Canton, MA 02021, retired December 31, 1979 as president, treasurer and owner of A.F. Underhill, Inc., Somerville, Mass. Al writes, "I retired and sold business and name and ran it under contract from January 1, 1977 through December 31, 1979." Hobbies are hunting, fishing, golf and boating. Travels have been to Florida, Canada, California and a lot of cruises to the West Indies, Bahamas, and South America. Wife Dorothy's main interests are fishing, boating and golf. Al writes: "Built a second home in Palm Coast, Fla., in 1976 but decided last year two homes were too much trouble and sold it. Plan to take more trips in the future." Your assistant secretary regrets to report the following deaths: **Dr. G. Bowditch Hunter** died June 1985, his last address was 3106 Teal Terr., Safeharbor, FL 33572; **Henry T. Gibbs** died February 16, 1986, he is survived by his widow Mrs. Henry T. Gibbs (Sylvia) of 797 Nyles Pl., Laguna Beach, CA 92651, and son Kenneth Gibbs; and **H. Berkey Bishop** who died August 1983.—**Lester M. Klashman**, Assistant Secretary, 289 Elm St., Apt. 71, Medford, MA 02155; **Robert H. Thorson**, Secretary, 506 Riverside Ave., Medford, MA 02155

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Hewitt Phillips was honored by the American Aeronautical Society in a ceremony awarding him rank of fellow. . . . **Richard Feynman** served as member of a Presidential commission to investigate the cause for space shuttle failure. . . . **Evan Pancake** reported from Charlottesville, Va., his "first" retirement from Texaco and his "second" retirement from five years as president of the Paperweight Collectors Association. . . . **Bob Touzalin** and **Aletta** wrote from Naples, Fla., of their plans to visit **Wiley Corl** in Boca Raton. The Touzalins expect to visit **George Cremer** and **Billie** in California during 1986. Ace golfers enroute are invited to communicate and tee up.

George Cremer and **Billie** continue travels from their Lemon Grove home and report exploration of a geothermal generator project on Hawaii and news about **Ben Badenoch's** pioneer design of a two-place, self-launching, cross-country sailplane. Last summer Ben won the Championship Trophy in the U.S.A. National Sailplane Competition. If the Cremer's visit EXPO 86 this year we hope to give **Billie** a chance to repeat her eagle on a par three.

Hans Bebie and **Astie** hosted a mini-reunion at their lovely Seabeck home. They thoughtfully arranged cooperation of the weatherman who provided a blue sky background for the snow capped 6,500-ft. peaks of the Olympics just to the west across the saltwater Hood Canal. Enjoying good company and a tasty lunch featuring fresh-caught Dungeness crab were **John Alexander** and **Nancy**,



Ben Badenoch, '39, last summer won the championship trophy in the U.S.A. National Sailplane Competition.

Jim Barton and **Mary**, and **Hilda** and **I. Heard** at lunch: The **Bebies** continue to be active in travels and skiing, the **Alexanders** completed modifications on their home in Bellevue where **John** is designing a five-way antenna for his ham radio communication to New Zealand. **Mary** includes tennis three times per week in her busy schedule and **Jim** continues to please his constituents as mayor of Hunts Point. At lunch there was reference to a generality: "You're not getting older, you're getting better." The consensus was, "we're getting better at getting older."

We are saddened by reports of deaths of three classmates: **Thomas B. Akin, Jr.** on November 3, 1985, in Fairfax, Va.; and **Robert B. Wooster** on July 18, 1985, in Boynton, Fla.; and **Edward Usher** on January 13, 1986, in South Chatham, Mass. There were no details.—**Hal Seykota**, Secretary, 1415 Seaciff Dr., N.W., Gig Harbor, WA 98335

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Clem Burnap writes that he is now vice-president for business development for D. Russell Associates (M.I.T. '44), after finishing assignment as project development manager for Dillingham Construction Corp. . . . **I.M. Pei** and his wife were guests at the White House dinner for Prince Charles and Diana, princess of Wales, recently.

More sad news to report—**Milfred**, widow of **John Beattie**, wrote that he passed away on June 24, 1985, at his home in Stamford, Conn. No other details are available.

Our class treasurer, **Ed Bernard**, reports that nine months after the 45th reunion the account can be closed. Briefly, there were 18 items or transactions. . . . 11 showed a net loss, one was neutral, and six showed a net gain. The final result was a net loss of \$713. An itemized report was sent to our class president, **Jim Baird**, in February for planning purposes for our 50th.—**Donald R. Erb**, Secretary, 10 Sherbrooke Dr., Dover, MA 02030, (617)785-0540

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Robert Wallace Blake, a faithful Seattle correspondent, had an urgent letter from **Charles S. Butt, Jr.** who has become '41s apostle for rowing. He appeals to all former members of "The Boat Club" to urgently sent some geld for much needed equipment. Our class had 28 members of

the Boat Club; please write Charlie at 977 Spencer Rd., McLean, VA 22102.

I recently spent two delightful days in Washington with **Peter H. Smolka**, senior partner of Burns, Doane, Swecker & Mathis patent attorneys. Peter received his S.B. and S.M. at M.I.T. in chemical engineering and his J.D. at Rutgers in 1949. Peter was born in Prague, where the Smolka's were well-known. His charming house, near Alexandria overlooks the Potomac in the distance. His wife Marjorie is a talented water colorist, her paintings are masterful, fresh and very fine indeed.

The class of '41 must thank our president **John Sexton**, veteran sportsman and his camping buddy, **Dward Howard** for planning our 45th Reunion, and **Leona Zarsky** for the Cape Cod part of the festivity. Leona and her husband Bud are both medical doctors, and like to cruise Nantucket sound in their beautiful sailboat. They have exciting plans to remodel their Cape house. I received a note from **Robert L. Sinsheimer**, chancellor of the University of California, Santa Cruz, and will report about him in more detail after meeting with him during the reunion.—**Joseph E. Dietzgen**, Secretary, Box 790, Cotuit, MA 02635

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I received nothing from Cambridge this month, except reruns of news and obituaries reported in earlier issues of the *Review*, so I am indebted to **Dick Feingold** for a clipping about **Virgilio Barco** (Course I). At the moment of this writing, Virgilio is the Liberal Party candidate for president of Colombia. The election still lies in the future, and the Liberal Party appears to be in the lead. But by the time you read these notes, the results will be two months old. Consult your local newspaper for the week following May 25.

If you don't send more news, I'll have to resort to the telephone again.—**Bob Rorschach**, Secretary, 2544 S. Norfolk, Tulsa, OK 74114

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Bernard Rabinowitz, president and chief executive officer of Atlantic Industries, has established graduate fellowships in technology policy at M.I.T. The Bernard Rabinowitz fellowships will be awarded to graduate students doing research on technology and policy under the cooperative supervision of faculty in both a technical department and in a department of either the School of Humanities and Social Science or the Sloan School of Management. The Technology and Policy Program is a graduate interdepartmental program whose role is to educate young men and women for leadership on technical issues. Now in its tenth year, it enrolls about 30 new students each year. Its graduates work worldwide both for private companies and public agencies.

Paul Heilman reports the Fairfield County group met recently in Norwalk, Conn. Present were Paul, **Holton Harris**, **Will Rodemann**, **Dottie** and **John Gardner**. **Bob Meny** and **Dave Jealous** missed the meeting due to out-of-town business. Some other class members might follow suit and start similar groups in their areas. **Will Rodemann** has joined **Holton Harris** in his company, **Harrel Corp.**, as vice-president of sales.

The reunion committee held a meeting on March 19 at the home of **Anita** and **Les Brindis**. Plans for another mini-reunion were discussed since the Williamsburg event was so successful. Details will be forthcoming.

Larry White has joined the ranks of our retirees. Larry graduated in Course VIII (physics) and served in the armed forces in World War II. He has moved from New Jersey to South Orleans, Mass., where he and Helen are having a home built. By the time you read these notes, he should be all moved in and enjoying the Cape Cod summer. At the time of his retirement, he was man-

ager of product development in the Chemical Division of Hoffmann-LaRoche, where he had been employed for the last 15 years. Prior to that time, Larry worked for 22 years in the Titanium Division of National Lead Co. He was a group leader in the Research Laboratory working on titanium pigments. Larry and Helen have two sons, both married, three granddaughters, and one grandson. Their hobbies are gardening, cooking, enjoying the beach, and traveling, although along with many others they are restricting to the U.S.A. until the situation stabilizes in many other countries.—**Co-Secretaries: Andy Corry**, Box 310, W. Hyannisport, MA 02672; **Lou Demarkles**, 53 Maugus Hill Rd., Wellesley, MA 02181

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Happy Easter, I mean Happy Independence Day! Yes, these notes are being written on a gorgeous Easter Sunday afternoon—and long overdue notes at that; our first in calendar '86.

Robert H. Johnston, advises that he retired from Exxon in 1980 and now does volunteer work in computers at the Senior Society Planning Council of Tallahassee, Fla. . . . **Jack L. Uretsky** of Hillsdale, Ill., joined the faculty of Elmhurst College in Elmhurst, Ill. as an associate professor of mathematics and computer science last fall. Jack has had a full career: three degrees from the Institute—S.B. in course XVI, S.M. and Ph.D. in course VIII plus a J.D. degree from the University of Chicago in '75; 40 published papers in the fields of nuclear physics, acoustics, elementary particle theory, etc. After a lifetime as a physicist, in recent years Jack has been associated with a Chicago law firm specializing in property law as well as patent, copyright and trademark litigation.

Rev. Charles J. Hooker, Jr., pastor of the Westminster Presbyterian Church in Wilkes Barre, Pa., for the past 17 years, indicates that he looks forward to retirement in a couple of years and thus is preparing for a third career assisting churches with computer programs. Since Charlie was Tau Beta Pi in electrical engineering, it is safe to assume that the first career was EE; however, it didn't last too long as Charlie entered Princeton Theological Seminary in 1946. . . . In mid February, **Dick Battin**, associate director of the NASA Program Department at the Draper Laboratory, was the 12th Von Karman Memorial Lecturer on "Space Guidance Evolution" at the 28th Israel Annual Conference on Aviation Astronautics in Tel-Aviv. Except for about a year at Arthur D. Little, Dick has spent his entire career at the Institute. Till! We have failed to mention USNR Supply Corps duty as a commissary officer in Bainbridge, Md.!

Emily Vanderbilt Wade, former president and chairman of the Boston Zoological Society and long-term officer of the Massachusetts Audubon Society, is back in the M.I.T. Corporation for an additional five-year term expiring 1990. . . . **Emmett S. Day** has retired after 37 years as professor in mechanical engineering at the University of Washington; Emmett served as associate chairman of the department for some ten years. . . . **Bob Schmitt** part owner and vice-president, engineering at Fluitron in Ivyland, Pa., manufacturers of high-pressure (120,000 psi!) equipment, advises that he recently danced the cancan with the ladies of the ensemble at Folies Bergere in Paris while on an M.I.T. Quarter-Century tour. . . . **L. Robert Gardner** is still practicing architecture in his hometown of Cedar City, Utah, near Zion and Bryce National Parks.

Jim Pickel, our class treasurer, enjoys his new-found teaching career as a part-time physics instructor at the Woodward School for Girls in Quincy. Jim, who describes himself as an addict of both golf and bridge, recently retired from Gillette Company in South Boston after a 25-year engineering career. . . . **Rev. John von Hemet** after 15 years as Rector of St. Paul's Episcopal Church in Alexandria, Va., has moved to a small country parish in Louisa, Va. John has had a varied career

when you consider he moved about with and for Mobil Oil from 1947 to 1962. . . . **David O. Richards** of Granville, Ohio, received a Distinguished Alumni Award from Dennison University in June 1985. Dave retired in 1982 as director of research and development at Owens Corning Technical Center in Granville. Yes, Dave attended Dennison prior to his V-12 transfer to M.I.T. in 1944; more importantly, he has been an active Dennison alumnus for some 40 years.

We trust that the **J. J. Strnads** enjoyed their winter trip downunder to New Zealand and Australia. How about a travel log by J.J.? . . . **Ellen** and **Jim Brayton** had a Swiss ski spree in late January and I trust that they were able to visit Kate and **Jake Freiburger** in either Dallas or Durango, Colo., per schedule in late March. . . . Although we have no confirmation, our Alcoa spies advise that **Tom Stephenson** has taken early retirement this past spring. How about that, T.I.? . . . **Fran** and I enjoyed our regular February visit from Jean and **Chris Boland**, our class president. Jean and Chris spent a few days cross-country skiing in Jackson, N.H., and usually stop by on their way back to Greenwich, Conn., after visiting daughter Elizabeth, a University of New Hampshire senior. We look forward to seeing Norma and **George "Bud" Hetrick** during one of their regular trips to Boston and Boston College where son Blaine enters his sophomore year this fall.

Lou and **Pete Hickey's** Christmas card included a *Boston Globe* clipping indicating that **Frank Gallagher** had sustained a severe dunking while surfboard sailing in Dorchester Bay. What will our Frank think of next. Fortunately all's well that ends well. . . . **Libby** and **Jerry Patterson's** Christmas card included a snapshot taken in Ireland while on a riding spree last September. A price-less Libby comment: "I drive a yellow pick up—no cowboy hat, beer can or shot gun yet—that's when one is really a Texan!" . . . **Trudy** and **Max Reuhmund** advise that their son Max III married a Miss McCabe last June 30th in Boston. Hopefully our Max remembers his daughter-in-law's first name by now! . . . **George Bickford** advises that his retirement position as a self-employed computer salesman to dentists goes well.

This, dear friends, exhausts the news accumulated the past several months. Have a great summer; hopefully one you might want to share with the class of 1945.—**C. H. Springer**, Secretary, Box 288, New Castle, NH 03854

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By now it will all have been said and done so far as the Class Gift is concerned. We trust that you all kicked in enough to reach or succeed our 1.5 mega buck target. At this deadline date we have half a meg left to go, and if we make/made it, we have president **Jim Goldstein** and his dedicated gift committee to thank.

We had a long telecon with Jim the middle of March and know he made an all-out effort to get all class members contacted by phone or in person. Among many other things he gave an account of his luncheon with members in the Washington, D.C., area early in the year to gain their support. They included: **Gill Devey**, a 'Double E' originally from McKeesport, Pa., who came to us in his senior year after doing his first three at the Naval Academy Post Grad School. Gill's currently a technology consultant in D.C. where he lives out on New Mexico Ave. . . . **Hillman Dickenson**, our retired Lt. General, running his own Technology Systems Associates in Alexandria while living out on Garfield Rd. N.W. in the District. . . . **Herb Hansell**, our very first class president (in case you hadn't remembered), originally from Salem, Ohio, and another Double E, who works with/for Jones Day Reavis & Pogue in D.C. where he also lives out on Connecticut N.W. . . . **Rod Jenkins**, a course Xer who appears to have retired, now living in Gaithersburg, Md. . . . **Ed Sellman**, good of 'Course XVler out of Cape Vincent, N.Y., a retired Navy Commander

working for the FAA and living in Vienna, Va. . . . **Dave Sherrick**, originally from Oak Park, Ill., powered his way through course VI to become president of CR International Inc. in Beltsville, Md., while living in suburban Bethesda. . . . **Ned Spencer**, a Miami Beach native and last-but-not-least course Vler, heads Advanced Systems of the Mitre Corp. in McLean, Va., and lives in Pottomac, Md.

We received an obit on **Henry Ward**, an aeronautical engineering fellow who was chief engineer of Ward/Turner Machinery in Cockeysville, Md., where he lived—and died—this past January.

So now it's on to Stratton Mountain for our glorious 40th reunion, September 26th. Trust you've all received/filled out/mailed (to **Dave Hoag**) your intentions for attending our MAIN EVENT along with your bio covering the last 40 years of your life. For my sake please send the bio even if you can't make the reunion. I'd truly love to know what all of you have been doing. Hope to see you sooner than later!—**Jim Ray**, Secretary, 2520 S. Ivanhoe Pl., Denver, CO 80222

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Our Class of '47 Professorship fund is building slowly. Understandably, class members have their own pet projects to support. However, in this effort for the 40th, consider the long-term advantages of putting a succession of professors in place. The imminent (I am writing in April) Institute endowment fund campaign includes professorships, and our gifts to the Class of '47 Chair can be considered to be part of that effort as well. That means we can make our gifts to the '47 Chair twice as big, and cover all the bases with the one gift.

As the Dow-Jones continues to rise (as I said, it's April), **Harl Aldrich**, our 40th reunion gift chairman, suggests contributing *appreciated securities* to our reunion gift. Think of the advantages; you won't have to figure out how much you paid for it (a possible problem if it was accumulated over a period of time); you pay no long-term capital gains tax on the appreciation; you'll hardly miss it—it's just a number on your financial statement; and the full market value at the time of the gift is tax-deductible (up to 30 percent of your adjusted gross). (In April we tend to think of these things . . .)

This year **Claude Brenner** planned and chaired the most successful M.I.T. seminar series in history. The series, "Alchemy for the Twenty-first Century: Earth, Air, Fire, and Water" assessed the prospects for food, population, pollution, and energy. Two notable high notes (get it?) began each meeting: first was the fine food at the Faculty Club this year, with rolls in the covered baskets which were actually *warm*, possibly reflecting the kitchen renovation; second was Claude's consistently remarkable introductions, which almost, but not quite, made superfluous any speech to follow. He certainly warmed up the crowd for what was supposed to be the main attractions.

George W. Smith has joined the Manhattan Consulting Group as a principal of the firm. He has been active as the chief executive of several manufacturing companies in heavy equipment, bottling, construction machinery, and processing. George specializes in strategic and product planning, market development, and international operations. He lives in New Vernon, N.J. After M.I.T., George earned an M.B.A. at a neighboring institution (up-river).

From **Carl Dengler**: "This year I retired from DuPont after 36 years, mostly in research management. They were busy, interesting years with some solid accomplishment to look back on. Retirement entry was helped by some construction work, but am getting increasingly used to the idea!" . . . Also "retired" is **Aaron Newman**: "Took early retirement at the end of September 1984. Keeping myself busy with a retail business I own and with other leisure and community activities."

ties."

Carol Tucker Seward writes, "Since you asked—1985 was an eventful year. I retired last year after 30 years at Ocean Spray Cranberries. It was a great place to work, but I'm finding retirement rather nice, too. Bill had already retired and needed company. . . . **Winnie Bennett Corniea** was east in early June, and we were able to spend time together in Rockport. Then Bill and I trailed **Hester Stickley Virgin** and her husband through England, Scotland, and Wales. We missed their tour by a week and regret we didn't see Hester and Bill. After our tour, we returned to Scotland to find **Kystra Lock** on the Caledonian Canal near Fort Augustus. My great grandfather was employed by the Canal Service for 68 years and tended the lock at Kystra for many of these years. It was truly a beautiful spot nestled in the Scotch hills three miles from town. The road there was single lane, and in some places the land between canal and Oise River was just the road's width. You hardly realized you were driving on the left. We explored the highlands further, again on single-lane roads with many passing turnouts, and had a chance to try the B + B's.

"In September **Ginny Ferguson Ean** and her husband Bill visited with us for a few days while they were east for a Ferguson reunion. It was great seeing **Winnie**, **Ginny**, and **Bill**. We acquired a 1923 Model T touring car last summer. We are the second owners and have a lot of work to do to get it restored. The whole family and especially three adult nephews are very interested in the project. Besides our many trips to Maine and occasional trips to Niagara Falls to visit family, we spend much time grandparenting. **Matthew** (age 9), **Amy** (age 7), and **Liz** (age 4) live right next door and know the way blindfolded to Mima and Bumpa's house. We have a definite advantage over many grandparents. We do enjoy retirement and recommend it. . . . You realize this letter reports on (including you) almost 50 percent of the class of '47 females."

To make her last statement true, I shall tell you about something I plan to do. I, **MOI** that is (see below for name), plan to visit my grandson **Rafael** (age 5), who, alas, does not live in even the next town any more. However, as you know, I love to have an excuse to go off to South America for a month or six weeks. I am thinking about spending May, or maybe June, or maybe September, in Buenos Aires with **Margaret**, **Jose Maria**, and **Rafa** in their apartment with the 14-ft.-high ceilings, balconies, and roof patio. I am also looking forward to visiting **Horacio Regini**, who is using 3-D Logo, which he has developed, in engineering design applications. I don't want to miss the July Logo-86 conference at M.I.T., but I may put off my trip south until the annual September Logo conference in Argentina.

We appreciate the following news from **Louis Rosenblum**, '42. "**Robert Whorf** died suddenly on April 5, 1986, in **Atkinson, N.H.** He is survived by his wife, **Ann Elford Whorf**; sons, **Jonathan Lee**, **Robert Charles**, and **Christopher Ben**; mother, **Mrs. Celia P. Whorf** of Connecticut; and sister, **Mrs. Ceal Lee Wheeler** of Connecticut.

"In a letter to relatives and friends **Ann** wrote . . . He died within minutes from a severe heart attack in the comfort of his own home. We are very grateful that, although untimely, his death was fast, peaceful, and pain-free. He was very much loved by us and will be sadly missed, but we believe the world will be richer for his having lived. We know you will share our grief and that we shall be in your thoughts . . ."

"Until the hour of his passing, **Bob** was deeply involved in mini- and microcomputer applications for three-dimensional designs, transportation systems, scholarly studies of polyhedra in the large family of stellations and instellations of the **Triakis Octahedron**, sculpture, home renovation, and gardening. This wide range of skills and accomplishments was typical of the two generations of alumni of the Institute in whose tradition **Bob** continued. His grandfather, **Harry Church Whorf**,

'95, of **Wellfleet** and **Winthrop** was an artist, designer, pageant director, lecturer, and leader in the **American Red Cross**. His father, **Benjamin Lee Whorf**, '18, a chemical engineering executive of **Weathersfield, Conn.**, was one of the pioneer thinkers and writers in modern linguistics. His extensive writings from 1927 to 1941 were published in *Language, Thought and Reality*, now in its 15th printing by the M.I.T. Press. This posthumous publication includes articles that appeared in *Technology Review* in 1940 and 1941.

"**Bob's** wide circle of friends overseas, as well as those in distant and nearby places in this country, are from his engineering and strategic planning responsibilities at **Ford Motor Co.**, **Philco Corp.**, **Auerbach Electronics Corp.**, and a number of small development companies for which he served as a thoughtful and productive consultant. His mathematical insights in solid geometry were supplemented by the production of precision parts for assembling **The Great Icosahedron**, **The Great Stellation Dodecahedron**, and more than a dozen other elegant regular, Archimedean, and stellated polyhedra. Geometric forms assembled from the kits produced by **Symmetrics, Inc.**, of **Atkinson, N.H.**, have been on display at the M.I.T. Museum.

"There are many people who will miss his sage advice, his keen interest in the work of others and his perception of future trends in many technical and economic developments."

Keep your news coming.—**Virginia Carter Grammer**, Secretary, 62 Sullivan St., Charlestown, MA 02129

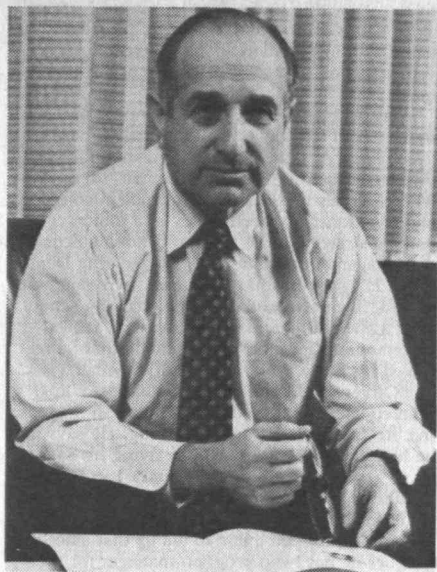
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Ken Brock is retiring as vice-president for development from **Polytechnic University** in **Brooklyn**. He and **Anne** are excited at the prospect, and after July 1 they will be able to savor the possibilities. They have converted their summer home in **Truro**, on the **Cape**, into a year-round residence (three bedrooms, so guests are welcome). During the next year they plan to prepare their home in **Pleasantville, N.Y.**, for sale, but plans are intentionally vague—since **Ken's** big goal is to make each day his own and not dictated by some fixed schedule.

Ken anticipates being involved in local affairs, and he will be close enough to **Cambridge** to be more active in M.I.T. and '48 activities. He will be doing some part-time consulting in fund-raising. He writes: "I'm finishing my 23rd year in fund-raising, and a change is in order. Yet, I cannot imagine more satisfying years helping, in some modest way, not-for-profit organizations obtain the resources to accomplish their noble objectives. M.I.T., Institute for International Education, New York Hospital-Cornell Medical Center, and now **Polytechnic** are where I've plied my trade from each of which I draw wonderful memories."

"It all started in 1963 when I joined the M.I.T. Alumni Fund with the fantastic proposition of being paid—not handsomely, but adequately!—to visit old friends from school. What more could anyone ask? The 14 years in various M.I.T. assignments were as rewarding as any I could imagine, and now these last nine in **New York City** have been equally exciting. We don't think it will be easy to leave the workaday world but we can't wait to try!"

Recently, **Ken**, **Anne**, and their adult "children" spent a glorious week on a **Caribbean** island. One evening, as **Ken** waited for a refill at the bar, he met a charming lady, **Sheila Cook**, who told **Ken** her husband also went to M.I.T. (she knew from **Ken's** ring!). It turned out that her husband was **Bob Cook**—a good friend in college, fellow member of **Senior Week Committee**, and a spring '48 mono victim, which made him miss all the graduation fun. **Ken** had not seen nor heard from him since then—38 years! **Bob** and **Sheila** live in **Princeton, N.J.**, where he has invested in real estate and she sells it. There seems to be some dispute as to which is the fam-



Bernard Gordon, '48, a recipient of the 1986 National Medal of Technology, is so honored for having "fathered" high-speed analog-to-digital conversion, which has been applied to medical, analytical, computer, and communications products. Currently president and chairman of the board of Analogic Corp., Peabody, Mass., Gordon has founded two companies and established a graduate-level institute in Wakefield, Mass. to teach engineering leadership.

ily profit center.

Harold Ottobriani has formalized his activities in mergers and acquisitions of companies by becoming a vice-president of Gryphon Management Co. in Boston. He renewed an old acquaintance with Arthur Vash, S.M.'53, because Arthur is also a member of the firm. Harold plays tennis with Jim Pastoriza and Dave Vigoda.

Harold has seen Dave several times recently. Dave was editor of *VooDoo*. After working to build up Norfolk Electric, Dave has retired from his firm and has been successful building condominiums. He and several partners, including Harold, are building a congregate living development in Sarasota, Fla. Dave spends the summers in Weston, Mass., and the winters in Florida.

Harold and Eleanor still enjoy traveling and have been to Spain and Portugal recently. They spend much time during the summer on the Cape. —Marty Billett, Secretary, 16 Greenwood Ave., Barrington, RI 02806, (401) 245-8963

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After an unanticipated hiatus your secretary presents class news and notables from several months.

Capt. Wm. Wicks, U.S. Navy retired, writes of the daily challenges of providing engineering services, primarily to the U.S. government. He is senior vice-president of EG & G Washington Analytical Services Center in Rockville, Md. . . . Alfred J. Conn is an engineering fellow with Landers Associates, Inc., engaged in the development of radar, radar counter-measures, IR counter-measures, and communication systems.

He is a senior member of the IEEE and serves on the Radar Panel of the Aerospace and Electronic Systems Society. . . . Harold G. Ingraham, Jr., course XVIII, is about to assume the office of president of the Society of Actuaries. He has served the Society in various capacities for several years and has been a speaker at several of its conferences. Harold is also a fellow in the Canadian Institute of Actuaries and a member of the American Academy of Actuaries. He is senior-vice-president for New England Mutual Life Insurance Co. in Boston where he is responsible for product development, marketing strategies and profit measurement relative to business insurance and pension programs.

Herb Federhen writes that he is still living in the D.C. area and working for the Institute for Defense Analysis. His areas of expertise are communications and battlefield sensors. Herb enjoyed the class reunion in Bermuda but suggests that at the next one "they keep Paul off the mopeds."

. . . Bruce Campbell is now the New England Regional manager for Tippetts-Abbett-McCarthy and Stratton; Engineers, Architects and Planners. . . .

Frank A. Dinnenn, Jr. after almost 15 years of second singlehood has married Geraldine "Geri" Fields. Geri is an elementary school teacher. . . .

Walter E. Morrow professor of electrical engineering at M.I.T., is also the laboratory director of M.I.T.'s Lincoln Laboratory. Lincoln Lab, an integral part of M.I.T., is a center for research and development in advanced electronics with special emphasis on applications for national defense.

Arthur Morrow writes enthusiastically about a far-reaching performance excellence program for which he is division coordinator. Arthur is also vice-president, Logistics, Inc. Dr. Morrow is also serving on the Study Group of the American Physical Society that will provide a definitive scientific report on directed energy weapons, weapons which figure prominently in "Star Wars."

. . . Harold A. McInnes, president of AMP Inc. of PPG Industries, Pittsburgh, Pa., has also become one of its directors. . . . John F. Moore is now the CEO of Bio-Imaging Research, a company which specializes in x-ray detectors, magnetic resonance imaging, and parallel-processor computers. Bio-Imaging designed and built prototypes of CAT scanners and hospital computer systems. They also design and sell industrial inspection systems using CAT scanners and digital radiograph scanning. . . . S. Leslie Misrock, a senior partner of Pennie and Edmonds, California Biotechnology Inc., has assumed a directorship there also.

Two '49 alumni have been elected to and are serving as members of the M.I.T. Corporation: Michael M. Koerner, president, Lyeva Investments Ltd., and president, Canada Overseas Investments, Ltd., and Milton Bevington, who is also president of the M.I.T. Alumni Association.

Ken Prytherch writes from Franklin Lakes, N.J., that after 36 years with GAF he has taken early retirement. He is spending a lot more time bird-watching, particularly outside the U.S.A. He travels with his wife on her numerous business trips to the Orient. Both of them hope to spend more leisure time in New York City and really enjoy the Big Apple. Ken also wants Joe Harian and Stu Powell to know he is starting his twine and tin foil balls. . . . Paul Miller has resigned from his position as director of Control Data Corp. in Minneapolis, Minn. . . . Bernard D. Steinberg has been a professor of electrical engineering at Moore School of Electrical Engineering, University of Pennsylvania, Philadelphia. Dr. Steinberg is also chairman of Interspec Inc., a medical hi-tech equipment company which he and others founded in 1979. . . . Burt Mendlin has retired from Longview Fibre Co. (Your secretary notices an increase in retirement announcements. Does that mean we are growing older or better or both?) . . . Orlien N. Becker presented a paper on load management at Northwest Energy Expo.

Antonio A. Armenante announces the arrival of two new Armenantes—Andre and Andrew (grandchildren). . . . Dennis J. Carney has resigned as chairman and CEO of Wheeling-Pitts-

burgh Steel Corp. . . . Richard H. Marlowe notifies us of a change of address to Ormond Beach, Fla. (Retirement, also?) . . . Walter E. Seibert, Jr., chairman of the New York section of AIME, invites you to lunch meetings on timely mineral resources and metal markets activities at the Chemist's Club, next door to the M.I.T. Club on the second Thursday of each month. Call Walter at (201) 833-0929 if you're in N.Y.

Bill Schneider is vice-president for development in the Systems Sciences Division of computer Sciences Corp. in Silver Springs, Md. He is still working with space programs and is heavily involved in the space station activities. . . . Eugene B. Skolnikoff will be stepping down as director of the M.I.T. Center for International Studies, a post he has held since 1972. Dr. Skolnikoff is returning to full-time teaching, research and writing in the Department of Political Science. Dean Ann F. Friedlaender of the School of Humanities and Social Science commented that under Dr. Skolnikoff's leadership the Center "has nurtured and developed important programs in security and arms control, technology and policy, Japanese culture and technology, development, and communications as well as providing a link between the Institute and the international community." She further noted that Dr. Skolnikoff's "unique contribution to the Center will be missed."

It is with regret that we learned from Bradford Endicott, Sustaining Fellow and Life Member of the M.I.T. Alumni Association, of the death of his mother, Pricilla Maxwell Endicott.

Walter Wagner, longtime editor of the *Architectural Forum* magazine, died in July 1985. Walter was the editor of numerous books on architecture and a fellow of the American Institute of Architects. A colleague, Paul Beatty, writes that Walter was a "comprehensive editor, eminent in the world of architectural journalism," a man Beatty describes as "a great companion—a gifted, funny and kind." . . . George Pines, Jr., vice-president, Bobrick International, North Hollywood, Calif., telephoned me and then sent a letter about Walter. George was Walter's roommate. Having heard only recently of Wagner's death George wrote that "Walter was not only a good friend but also one of the most important elements of my M.I.T. education." It is clear Walter Wagner is missed.

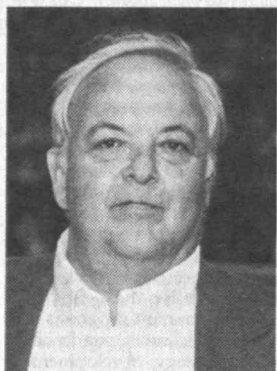
One of the benefits of being a class secretary is the receiving of phone calls from schoolmates of long ago. Len Newton called shortly before leaving for China leading a group of M.I.T. Alumni, and Joe Apeiman called from Covington, La. Joe like so many at M.I.T. during the 1940s was there as a serviceman in the U.S. Navy. These phone calls and all news is very much appreciated. Not necessarily published in a timely way, but published and read by old friends. Please continue to write and call.—Barbara Feeney Powers, Secretary, 200 Temple St., W. Roxbury, MA 02132

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Memory is not to be relied upon. For example, I always remember Harold McAleer dressed in a ROTC uniform, with a big grin on his face. At least part of this memory is very likely no longer accurate. What brought this to mind was a notice that Harold has been named group vice-president in charge of CAE software at GenRad. He used to be senior vice-president of corporate quality control. As a result of the change in job he is moving from Concord to Fareham, England. I hope the grin still persists. . . .

In the February/March issue I quoted Lucy Miller of the Student Financial Aid Office to the effect that no class descendent was enrolled as an undergraduate. This statement alarmed Edward Remmers, of Ridgefield, N.J., to the extent that he wrote both Ms. Miller and me to point out that his daughter, Barbara, was in her junior year at M.I.T., in course 18. I expect there are other children of class members who are undergraduates, also. Since we stipulate that all of our de-

scendents are bright, I can only assume that what Ms. Miller meant was that no undergraduate descendants qualified for financial aid because their parents are too prosperous. Of course, we must allow for some discrepancy between what we and what the Student Financial Aid Office may consider to be an acceptable level of prosperity.



**Burton
Richter, '52**

Burton Richter has been appointed to an advisory board at Lincoln Laboratory. The board's 12 extremely distinguished members will give advice on the research programs at Lincoln Lab to its management and the M.I.T. administration. Burt is director of the Stanford Linear Accelerator Center. Sidney Drell, SLAC's deputy director, is also member of the panel.—**Richard F. Lacey**, Secretary, 2340 Cowper St., Palo Alto, CA 94301

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Lots of East Coast news from the illustrious class of '55 this month. I'm sure that many of you saw a full-page, crew-cut **Russ Meyerand, Jr.** peering at you in a recent advertisement for *Scientific American* which ran in a number of journals and newspapers (and was reprinted in the *Review*, April 1986, p. MIT 31). Russ has been at United Technologies since 1958, where he is now vice-president of technology. The ad reported that he sees his progression from scientist to manager of science as a natural one for him and a vital one for the corporation. As he so aptly puts it, "Scientifically trained people bring to business a great majority of the new ideas, the new products, the higher productivity, the things that make a difference to you and me." Russ makes his home in Glastonbury, Conn., with wife, Mary Grace (once a special student at M.I.T. and daughter of M.I.T. Professor E.A. Guillemin, who was a pioneer in his work in electrical engineering), and their daughter, Mary Elizabeth, who is a senior in high school and may be a member of the M.I.T. class of '90. Russ plays tennis, sails, and in winter has a workshop in his basement, where he does wood and metal model-making.

Jukka Lehtinen reports from Finland that he is running his own consulting engineering business in Helsinki. . . . **George A. Goepfert, Jr.** is back in Houston, Tex., at the old family homestead and with Esso Eastern after seven years in Hong Kong. Friends visiting the space center are welcome to go see him.

We have learned that **Allen G. Tarbox** has recently joined Indian Head Data Services, Inc., as president, where he is in charge of data processing services and operations for Indian Head Banks. He was vice-president of operations at ILI Systems, Inc. in Bedford, Mass., for the prior five years and also had eleven years of experience as vice-president of Lexington Computer in Woburn. Allen lives in Burlington with his wife Betty and their two children.

Don Welsh is vice-president of the Transcat Division of Transmation, Inc., where he has successfully put the company into the mail-order business. *Test and Measurement Instruments* is a

best seller over the last five years, and *Laboratory Instruments* is in its first edition. Don, with his wife Barbara, divide their time between their home in Pittsford, N.Y., and a cottage on Cayuga Lake, where they spend most weekends from mid May to mid October. Barby returned to college and earned her nursing degree in 1978. She works part-time at a nursing home. Their oldest son, Don Jr., is a dentist in the Boston area. He is an avid biker and arrived on our doorstep in Sherborn one day last summer to say hello. Their daughter, Ann, is married, lives in Rochester, and works as a nurse in the neonatal intensive care nursery at University of Rochester Medical Center. Jim works for a florist and lives in Rochester.

For those of you who have already made that first \$1 million and are wondering how to invest it, **Ralph Wanger**, who runs the Chicago-based Acorn Fund, provided the answer in a full-page spread in the February 10, 1986, issue of *Barron's*. He looks for growth stocks and, as *Barron's* stated, "Despite his appetite for risk—or because of it, he might contend—the 51-year-old Wanger has racked up a pretty decent record. In the last 10 years, for example, the Acorn Fund has appreciated 740 percent or, on average, 23.7 percent a year." It was a pleasure to see Ralph again at the reunion and to meet Leah Zell who became Mrs. Wanger on June 30. Congratulations! Ralph also reports that he now has two employed computer type sons—Eric at Wallace Computer Systems and Len at Rockwell.

We have also learned that **Dick DiBona**, chairman of the board and chief executive officer of M/A Com, was hospitalized with a stroke in February. At this writing in April, his wife Emma reports that he's progressing better than expected and was discharged April 4 from the hospital. More later!

Keep those cards and letters coming!—**Robert P. Greene**, Eastern Co-secretary, 37 Great Rock Rd., Sherborn, MA 01770; **DuWayne J. Peterson, Jr.**, Western Co-secretary, 1841 Warwick Rd., San Marino, CA 91108

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By the time these notes appear in print, the one and only 30th reunion of the class of 1956 will have been relegated to history, and a new slate of class officers will have been elected. These class notes are therefore my swan song as class secretary. It was an interesting experience saddened by the fact that during these past five years the number and frequency of obituaries have increased significantly. Given the vintage of our cohort, this trend will of course continue relentlessly. As a favor to the next class secretaries, I urge all classmates to provide information about themselves for publication in the class notes so that these do not solely become an obituary column.

Fortunately, there are no obituaries in this month's column, and I can finish my term reporting the pleasant news that **Haim Kennet** (Course XVI) was appointed vice-president of research and engineering of the Boeing Aerospace Co. Haim's previous assignments at Boeing include the direction of the central technical staff, management of the company's NASA and civil spacecraft organization, and direction of its NASA systems organization. Haim has been on the staff of The Boeing Co. since receiving his doctorate in aeronautics and astronautics from M.I.T. in 1961.—**Robert Kaiser**, Eastern Co-secretary, 12 Glengarry, Winchester, MA 01890 (617) 729-5345; **Caroline Disario Chihoski**, Western Co-secretary, 2116 W. Davis Ave., Littleton, CO 80120 (303) 794-5818

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Mirabile Dictu—A third consecutive issue with notes from the class of '59!!! We hope that this

will become a regular feature in your future *Technology Reviews*. This month's column will be relatively sparse due to the dearth of input from you all. If you want to see this change, please drop us a line with information about yourselves, or if you're modest and shy, about one of our classmates.

Marv Manheim writes that he is now in his third year at Northwestern University where he is the William A. Patterson Distinguished Professor of Transportation. He teaches courses on computer techniques to assist human problem-solving and on information technology as a tool of competitive strategy in the Kellogg Graduate School of Management and the Civil Engineering Department. He goes on to say that their two daughters, Marisa, 5, and Susannah, 9, are enjoying school, music, swimming and ice skating. . . . **James Rogers** writes to inform us belatedly that he received his Ph.D. from UCLA in December 1980.

. . . **Oliver Seickel** notes that he has been appointed staff vice-president of American Standard Inc. in charge of corporate planning. He says that he has some (little) time left for flying his sailplane at the Somerset, N.J., airport. . . . **Bob Broder** was recently named a director at Voinovich Monacelli Architects in Cambridge. . . . **Bob Rosenfeld** dropped a line to tell us that since last October he has been program manager for robotics at the Defense Advanced Research Projects Agency (DARPA).

In searching through the Canton Library for something interesting to read I came across a recent addition titled *Future Rich* by Jacqueline Thompson (Wm. Morrow & Co.) which is a tour of America's entrepreneurial activity in which she names the men and women most likely to be the most successful and wealthiest at the turn of the century. In addition to such recognizable individuals as Jane Fonda, Steven Jobs, Bob Guccione, Dr. Robert Jarvik, Ted Turner, Ken Olsen and T. Boone Pickens, she mentions five of our classmates: **Bob Harp**, **Pat McGovern**, **Stu Mott**, **Bill Poduska** and **Sheldon Razin**. An interesting book for those of us with the entrepreneurial spirit who could use reading about the successes of others to get us through the inevitable "down" times.

Speaking of entrepreneurial spirits, **Mel Platte** made a presentation on his company, Impact Systems Inc. at a session of the M.I.T. Enterprise Forum. The company, founded in 1980 has developed and markets computer-aided sales and computer-aided marketing support software. . . . **Elmer Delventhal** writes that he will be on a teaching exchange in England next year with his wife Linda and son Matthew, 7 months. They will spend ten months in James Herriot country. . . . Finally a note from our class treasurer **Jack Fischer** informs us that his company, Walbar was acquired in December by Colt Industries. Jack will be staying on as vice-president of finance and administration. Jack also relates that **Larry Bishoff** has left the Institute after 25 years to become assistant to the president at the Harvard Community Health Plan (which I am informed has no affiliation with Harvard University).

Again this month, I am offering to those of you who could not attend the fabulous 25th reunion and are interested in receiving the questionnaire results and picture/biography book, there are still a number of these fascinatingly interesting documents still available. Just send me your class dues (\$25.00 tax deductible, this year at least) and you will receive same by return mail. Also, send along any tidbits about either yourselves or a classmate for reporting in a future class notes to: **Art Collias**, Co-secretary, 24 Hemlock Dr., Canton, MA 02021 (617) 828-5073; **Ron Stone**, Co-secretary, 116 Highgate Pl., Ithaca, NY 14850 (607) 257-2249

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It's kind of hard to write a column one knows will be seen after the reunion but, for practical

reasons, is written long before the date. At this writing (in late March) plans were going well with a truly gala evening at the Boston Opera House, a great clam bake, cocktail parties and living group reunions in the offing. The response from Senior House classmates has been astounding with about two-thirds planning to come. I imagine other groups have been equally responsive. I'm looking forward to the reunion with great enthusiasm. I'll report whether it lives up to my expectations in a column later in the fall.

I got a pleasant letter from someone last fall who neglected to sign his name! Whom ever it was says (s)he graduated in course XVIII, tried Harvard Law, the Public Health Service and got a Ph.D. in regional science. Now she is in Florence, Italy, on a Fulbright Fellowship. I wish I knew who this was. Please write!

Sam Lord is now a vice-president of Phoenix Mutual Life. He has worked there since 1961 and is an actuary. Now he is in charge of financial analysis, pricing and computer systems in the pensions area. Sounds like he runs the whole show!

That, I'm sorry to say, is this month's mail. I'll have a lot more to write about after the reunion. If you can't come at least you can write.—**Andrew Braun**, Secretary, 464 Heath St., Chestnut Hill, MA 02167

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Arthur Roger Cooke is now associate professor of biophysics at the University of California in San Francisco. He and his wife, who is a research scientist at a local genetic engineering firm, have one child, age 3. Arthur notes that while many of his classmates are considering what college their child will attend, he is doing the same with day-care centers. . . . More articles about **Virgil G. Cox's** new book, *Automation and Control for Marine Engineers*, appeared in the local newspapers in Maine. . . . **Scott L. Danielson** is now vice-president and technical director of architecture for Parsons Brinckerhoff. He is project architect for stations in the new Singapore Rapid Transit System. He has also traveled to Perth, Australia, to guide the electrification of a suburban rail line, which he says will help Perth get ready to defend the America's Cup!

Neil Doppelt is currently in charge of information consulting services for Distribution Industries in AA & Co.'s Chicago office. He recently completed renovation of a 1920's Georgian home in nearby Glencoe. . . . **Joel Karp** founded an authentic Silicon Valley semi-conductor start-up company, VISIC, Inc., which stands for visionary integrated circuits. The company designs, produces, and markets very high performance CMOS memory chips. . . . Our revered class president, **Bardwell C. Salmon**, is now back in the Boston area as an officer of Computervision and vice-president and general manager of North American sales and worldwide marketing. Bojey writes that he is looking forward to working with fellow classmates on the 25th reunion in the spring of 1987.

Dan Thornhill describes himself as one who came to Boston to college and never left. He lives in Arlington, works at Intermetrics in Cambridge, and says that his year-old solar hot water system is great. . . . **Jon L. Zellers** is now president of Decision Systems Associates, Inc. of Rockville, Md., a software development company specializing in optimal solutions to large-scale transportation network systems.—**John Prussing**, Secretary, 2106 Grange Dr., Urbana, IL 61801

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Leland Jackson, a fellow of the IEEE, was one of the faculty of a symposium held recently in Cambridge and Palo Alto on digital signal processing (DSP) and DSP chips. Dr. Jackson has worked for Bell Labs, and Rockland Systems, and is now pro-



Neil Doppelt, '62 (right), and his wife Elizabeth recently completed a year-long renovation of their 1920s Georgian home in Glencoe, Ill., less than two blocks from Lake Michigan. They did all the demolition and decorating themselves.



fessor of electrical engineering at the University of Rhode Island. . . . **Jim Hallock** is the new chief of the aviation safety division at the DOT Transportation Systems Center in Cambridge. . . . Also working in Cambridge is **Alex Levis**, who is with the Institute's Laboratory for Information and Decision Systems. He is also president-elect of IEEE's Control Systems Society.

The University of Chicago Press reports publication this past November of *Mathematical Physics* by **Bob Gerch**. Available in both cloth and paper, the book is based on Bob's course at Chicago, where he is professor in mathematics and physics. He attempts, he says, to apply math to 20th century physics in a way that preserves intuition and insight.

I received a nice letter from **Bruce Eisenstein**. Bruce is still head of the Department of Electrical and Computer Engineering at Drexel University in Philadelphia, where he has presided over a five-year ten-fold increase in research funds. Recently he organized and chaired a meeting of some 90 electrical engineering department heads held at Hilton Head, S.C.—**Richard Adler**, '43, of M.I.T. was one attendee. Bruce was recently elected fellow of the IEEE. He lives with his family at Wyndmoor, Pa., near **Dan Ross**, who prac-

tices law in Philadelphia. The oldest Ross and Eisenstein boys share interest in computers and fantasy games.

When you read this, it will be the hottest time of the year. So relax, pop the top on a brew, and write a few words to this column—to share triumphs, tragedies, or just the commonplace with your classmates. We'll all appreciate hearing from you.

You may have noticed a decline in the undersigned's customary loquaciousness and verbosity. This has resulted proximately from my engaging in a new vocation, taxing my limited resources of time, energy, and words. Since early March I have been a "systems consultant" (that means sales rep) dealing in business microcomputer systems at the Entre' Computer Center in Timonium, Md.—**Phil Marcus**, Secretary, 2617 Guilford Ave., Baltimore, MD 21218 (301) 889-3890

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This month we start a new (intermittent) feature to help focus thoughts on our upcoming reunion: "What Were We Doing 25 years Ago?"

As I'm writing, it's early April and, as best I



Art photographer Gus Kayafas, '69, wanted a wide-format camera that could be hand held. He couldn't find a suitable one for his work, so he designed and now manufactures one, as president of Palm Press, Inc., Littleton, Mass.

can remember 1961, a lot of us were getting ready to participate in Centennial Weekend. I recall a formal dance and a train ride out to Sturbridge Village to hear Pete Seeger sing. If any of you have any more specific recollection or other events you thought were highlights of 25 years ago, please drop me a line.

As previewed in an earlier column, I am now very happily married to Louise Hersey and we are closing in on being established in our new house in D.C. Louise and I enjoyed a fantastic trip to Australia—unfortunately we only had time enough for Sydney and the Great Barrier Reef but would go back in a minute. As you may know, the trip from the East Coast is a long one. The outbound portion was 30 hours, we counted a total of 46 hot towels on the round trip. Our wedding allowed Louise and me to spend some “family time” with my daughters, Jennifer, 16, and Becky, 14, who spend most of their time in Massachusetts and Oklahoma, respectively.

The wedding also provided a chance to see Ellen and Gary Walpert and Bill O'Halloran. Gary recently joined the law firm of Hale and Dorr in Boston. He, Ellen and their three lovely daughters continue to reside in Weston. Bill's start-up systems analysis firm, Synetics, is prospering with several recently competitive government contract successes. Bill and his two sons are living in Reading, which is also home office for Synetics.

Don Silversmith sent along a December 1985 clipping from the *Washington Post* noting that his 12-year old son, Jol, had an M.I.T. '64 tee-shirt pilfered from his junior high school locker in Rockville, Md. Don would like to know who has the extras leftover from our 20th reunion so that he can replace the shirt for Jol. If you've got a spare shirt, Don's home address is 260 New Mark Esplanade, Rockville, MD 20850. . . . Bob Gray sent a nice note telling of his activities at Stanford, where he has been since 1969. He is currently an electrical engineering professor and director of the Information Systems Laboratory. Bob's research areas include data compression, high speed A-to-D conversions and speech coding and recognition; he also “dabbles in information theory and ergodic theory for fun.” He co-authored the book *Random Processes*, published by Prentice-Hall in January, and is busy writing another. In news from the “look how old we're getting” department, Bob's son Tim is a junior at UCSB and his daughter will be a June 1986 high

school graduate. . . . Julian Adams is general manager of a Chrysler-Plymouth dealership in Lynchburg, Va., and was recently elected to an at-large seat on the Lynchburg City Council. (Could this be part of a Lee Iacocca plan to take over the political infrastructure of the U.S.?) Julian's current extracurriculars include white water canoeing, squash, distance running and a large bonsai collection.

Gary Rauch, with spouse Beth and sons Pete and Mike, left “humid, cloudy Pittsburgh” last summer to join Digital Equipment Corp., storage media operations in Colorado Springs. He is applying knowledge of magnetic behavior of materials, gained over 13 years with the Westinghouse R&D Center, to develop future generations of metallic thin film recording media for hard disk drives. The Rauchs report that they love Colorado and have finally made it to the ski slopes. . . .

From Titusville, Pa., comes the word that Jack Downie and his family—wife, Darlene and daughters Adrienne, 12, and Michelle, 7—are “enjoying life.” Maybe mid-life crisis has skipped over northwest Pennsylvania. . . . Mike Auerbach is assistant director of specialty chemicals R&D at Pfizer in Groton, Conn. His son got his driver's license this year and now “drives us crazy with official sanction.” . . . Fellow Washingtonian Roger Lewis is still teaching architecture at the University of Maryland and practicing architecture in D.C. He writes a weekly column on architecture and urban design or the *Washington Post*, which I enjoy and which the American Institute of Architects honored with a service award. Roger's first book, *Architect? A Candid Guide to the Profession*, was published by M.I.T. Press in 1985.

I'm holding onto a few more Alumni Fund notes for future columns. Please remember that letters sent directly to me get instant top billing and also remember the reunion, less than three years to go.—Joe Kasper, Secretary, 3502 Idaho Ave., N.W., Washington, DC 20016

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In response to a classmate's inquiry, Dave Manalan sent some information about the 1985 class reunion book. The books were mailed to all persons for whom Dave has records of payment, using the Institute's 1986 address list of mailing. Extra books are available in return for a check for \$20 payable to “M.I.T. Class of 1965” mailed either to Class of 1965, M.I.T. Alumni Association, Room 10-115M, 77 Massachusetts Ave., Cambridge, MA 02139 or to Dave (M.I.T. Class of 1965 Treasurer), 7 Kelley Rd., Acton, MA 01720. If you believe that you have been overlooked and have not received a book that you paid for, send Dave a Xerox copy of any cancelled check that was payable to the class or to M.I.T. between February and June 1985. Dave says that the first fifteen requests for the 1985 book will also receive the 1980 book at no extra charge.

David Johnson writes that he and family are now living in Washington, D.C., and have just had their second child, born January 28. Dave is doing a full-time internship in preparation for parish ministry, at the Unitarian Church of Arlington, Va. Dave would enjoy hearing from classmates who may be living in, or just passing through, the Washington area.

As you may have read in the *Review*, Margaret MacVicar is now dean for undergraduate education at M.I.T. She is quoted in a long interview in *Tech Talk* as seeing her appointment as a statement by the administration that M.I.T. must have at its heart commitment to a world-class undergraduate educational program. She also mentioned an interest in expanding students' creative and design capabilities, and the need to enhance their exposure to the arts and humanities. . . . A related article in *The Tech* reports that Benson Snyder, who was psychiatrist in chief at M.I.T. when we were undergraduates, has continued to follow his study of a sample of members of our class. The article reports that Snyder has com-

pleted interviews with 50 of the original 54 members of the in-depth sample of the class, and that 11 have made “significant contributions to their fields.” The article also quotes Snyder as observing that despite such changes as the introduction of the Undergraduate Research Opportunities Program and freshman pass/fail grading, some people still graduate from M.I.T. unprepared to think sensitively about the human world, and allow M.I.T. to “define them as individuals-by grades, etc.” It will be interesting to see if the continuing study produces another book to follow Snyder's *The Hidden Curriculum*, published in 1971 about early results of the study.

So much for July, friends. Send more fund envelopes so I'll have something to write.—Steve Lipner, Secretary, 6 Midland Rd., Wellesley, MA 02181

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News is especially slim this month. Please write. . . . Kiki and Mike Rosenblum are the proud parents of their first child, a son, Morgan Evans, born April 21, 1985. Mike has been in touch with Larry Gottlieb and Jim Foster, and reports that they “look great and are doing fine.” Mike is a textile importer and travels to India several times a year. He and Kiki are looking forward to our 20th. . . . John Fittz has been at Combustion Engineering five years. He is a senior buyer for instrumentation and controls, including data acquisition and processing display systems for nuclear and fossil steam supply systems. He is living in Granby and enjoys visiting Boston and Cape Cod on weekends.—Jim Swanson, Secretary, 878 Hoffman Terrace, Los Altos, CA 94022

69

Your hard-working class secretary is typing these notes five minutes before dashing off to sunny Florida by car to show the kids Disneyworld and Epcot. Bless you—this time only a few notes!

George Flynn writes: “I have left Embury-Riddle and sunny Florida to join the faculty of the State University of New York at Plattsburgh on the scenic shore of Lake Champlain. Just to make sure I adapted quickly, we've already (January) had an 18 inch snowstorm.” . . . And from master-builder David Brown we have: “My residential design and construction practice is doing very well, having more than doubled its volume in the past year. I have pretty much retired from the carpentry work, concentrating on design and management, leaving the actual building to my crew which now numbers four.”

I envy George's move just across the lake from my favorite state, Vermont; plan to move there some day. Now if David can just show me how to build an inexpensive solar house on 100-acres up north, our family will be able to retire from this Washington madness and get down to some serious business. “Life is too short to dance with ugly men.” I'll sign off with that cryptic remark.—Eugene F. Mallove, Secretary, 11902 Paradise Ln., Herndon, VA 22071

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Neil R. Vanderdussen has been promoted from president of the U. S. Marketing Division of Sony to president and chief operating officer of Sony Corp. of America. . . . Nick Escott has been appointed chief pathologist for St. Joseph's General Hospital and Port Arthur General Hospital in Thunder Bay. In his spare time, he enjoys bird-watching, photography, and driving his kids to the ski hill. . . . Julie Sussman through M.I.T. Press, is offering her *Instructor's Manual to Accompany Structure and Interpretation of Computer Programs*, a text book used in 6.001.

Thomas D. Halket has become a counsel to Summit, Rovins, and Feldesman in New York

after having left as assistant general counsel to Engelhard Corp. He had previously been an associate with a law firm after graduating from Columbia University School of Law. He specializes in being counsel to high-technology companies and was recently elected secretary of the Science and Technology Section of the American Bar Association and chairman of that section's Division on Ventures and Enterprise. He is also secretary and director of M.I.T. Club of Westchester. He and his two sons and wife live in Larchmont, N.Y.—**Robert Vegeler**, Secretary, Beers, Mallers, Backs, Salin & Larmore, 220 Fort Wayne National Bank Bldg., Fort Wayne, IN 46802

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John Welch writes: "Currently manager of F404 services engineering for General Electric's Aircraft Engineering Businesses Group in Lynn, Mass. My wife (Debby Dunphy) and I live in Lynnfield. I got out of the U.S. Navy because I got tired of going down to the sea in ships, but now our favorite hobby is boating up and down the New England coast. Not ready to re-enlist, though."

... **Jacqueline F. Whitney** writes: My husband Gene and I wish to announce the birth of our son Christopher Russel Siren on July 28, 1985. I'm managing to combine motherhood with teaching at the University of Pittsburgh. ... **Peter G.H. Hwang** is marketing manager of AIDA Corporation which has announced a new high-performance CAE (computer aided engineering) workstation capable of handling more than 250,000 gates at five million evaluations per second.—**R. Hal Moorman**, P.O. Box 1808, Brenham, TX 77833

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John Clippinger is a math and physics teacher at Beaver Country Day School. He and wife Susan live in Jamaica Plain. ... **Robert Thomas** has left architecture (he was an architecture and planning coordinator in the Baltimore Renaissance) to be collections manager for the Choice Card people. ... **Daniel Shalom** graduated med school at Rutgers after two years at Tufts. He will be doing a residency in neurology at Kaiser (L.A.) Hospital after a year's work in internal medicine in the New York area.

I am still here. Write.—**Robert M. O. Sutton**, Sr., "Chapel Hill," 1302 Churchill Ct., Marshall, VA 22115

74

Howdy children, how does your garden grow? Did you get your peas in on time? Did you remember to use lime this year? For those of you living in Manhattan or Georgetown, "garden" is like "flowerpot" only bigger and outdoors.

Your faithful scribe spent five days in mid-March skiing in Utah. Powder, baby. Up to my knees in it. Skiing is something I've only been doing seriously the last three years or so. Are any of you pursuing hobbies or interests now that you didn't like (or couldn't afford) when you were in school? Drop me a note and I'll give you a paragraph or two to expound about it.

There are quite a few personal letters in the mail with news this month. To all who have ever written, or who ever plan to write, I thank you. I also apologize in advance because I never answer them, just put them in here.

Quote of the month: "If I only had a little humility I'd be perfect!"—Lee Iacocca. Now on with these notes!

Miriam and **Chuck Rosenblatt** are now the proud parents of a daughter, Naomi Rachel. Chuck had a brief flirtation with Brookline politics although that ended in 1984 with his defeat for re-election to the Town Meeting. "I had the last laugh, though," says Chuck, "moving a month

later to Newton, where I have absolutely no political ambitions." He is deeply involved in his research program at the M.I.T. Magnet Lab doing what everyone committed to research learns to do: Looking for funding! Oh, if only earning a living didn't involve money!

Two short notes on the back of contribution envelopes. **Marc Goldring** is working at AT&T Bell Laboratories on applications of computer networks to telecommunications. ... **Warren Levy** is involved in the development of new therapeutic and diagnostic compounds for the pharmaceutical world. Did I say "involved?" He's the president of Unigene Laboratories, Inc. of Fairfield, N.J.

... From the Office of Public Information at the General Electric Research and Development Center, Schenectady, N.Y. comes news that **Frederick Faltin** has been elected to the editorial review board of the *Journal of Quality Technology*. His work at GE has developed a statistical quality system for a fully-automated factory for the machining of aircraft engine parts.

The winner of this month's *Cramp de Writer* award is **Naomi Markovitz**. Naomi put pen and hand to paper and wrote me a long letter, summarizing the last few years. Naomi has not chosen an easy path to wander, but has spent eight of the last nine years living, working and teaching in a Kibbutz in the Beit She'an Valley in Israel. As you all know, the rationale for a Kibbutz is simple: "It's too desolate out here or only a few of us to survive, so let's get 600 or so others with us and we can all be desolate together." Her letter details a life of work and commitment. Her teaching has been mostly with very young children (under six years of age) or with teaching teachers of elementary school children. This year she's on leave of absence and is living in Tel Aviv, teaching again. Whew! Good strength to you.

Sharon and **Alan Horowitz** announce the addition of a new model in the Horowitz line, Joel Noam, an addition to their already ever-popular line-up of Daniel and Eric. Daddy is an assistant to the solicitor general at the U.S. Department of Justice. Sharon's a librarian at the Library of Congress. She closes her note with this line: "We enjoy your column—when it appears." Cute, Sharon, but a point well-taken and it leads me to the announcement of a new regular-type class secretary, **Rich Sternberg**, who will be writing a column here every other month. Write to him. Tell him your news. Tell him your stories. Tell him your tales of triumph! Send the words to Rich, and the money to me.—**Lionel Goulet**, Secretary, 21 Melville Ave. Dorchester, MA 02124; **Richard Sternberg**, Co-secretary, P.O. Box 3209, Alexandria, VA 22302

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Only one item of news this month, but a happy one indeed. **Stephen G. Dawson** became the proud father of his first child, Phillip, on May 3, 1985. Congratulations!

Come on, classmates, help me fill this column. Surely, you've got some news to tell me—hopefully suitable for publication!—**Jennifer Gordon**, Secretary, 18 Montgomery Pl., Brooklyn, NY 11215 (or c/o Pennie & Edmonds, 1155 Avenue of The Americas, New York, NY 10036)

76

We have an extremely laconic note from **Peter Horowitz**, "Skiin', surfin', snowbirdin', swell city." ... **Robert Aquadro** writes, "Married, two children. Work for family-owned business; father and uncle, who started the business, are both M.I.T. grads; recent construction boom in the area makes them happy. Member of the Education Council." **Todd Harland-White** says "Celebrated our 10th wedding anniversary with a cruise in the Caribbean—was a seaskic naval architect! Evading wallpapering and interviewing

on the Education Council, but not very successfully." ... **Douglas Denholm** is currently working with the energy process engineering group of Champion International at its West Nyack Technical Center.

From **David Littleboy**, whom we haven't heard from in approximately ten years: "After three years and three masters' degrees at Yale (M.A., East Asian studies, M.S., M.Phil., computer science) and a year at a local A.I. company, I'm heading back to Japan. From a 30-person company to the fifth largest employer in Japan—should be quite a change!" ... **Steve Edelson** is currently living in Wayland, Mass., with his wife Lori and daughter Lisa. They are expecting a second child in July. He says "I have founded a small company Edsun Labs, which designs and sells semiconductors. All is going well, in spite of the general semi business. Luckily we are too small for the Japanese to notice." Steve designs, manufactures, and sells chips and boards which improve drastically the quality of computer graphics in PCs, making straight lines truly straight and circles truly round, rather than approximations. It is called the continuous edge graphics system. In *Computer Design* magazine, December 1984, is a review of another product of his, the EL 286-88 processor convertor. It is a better chip for the design and construction of IBM PC-AT compatible computers. It was also favorably reviewed in *PC Week* (June 18, 1985).

Carol Steiner is now a professor at New York University in chemical engineering and is happily living in Manhattan. She has grad students, research projects to do, proposals to write, and undergrad students to teach. It is quite a different world from industry in Philadelphia, and I am glad to report that she is enjoying the change a great deal. ... **Dominic Zito**, M.D., is now the senior resident in, I believe, cardiology, at a hospital in Brooklyn. He is enjoying internal medicine and its offshoots a great deal.

As for your secretary, he has been doing some futures-related consulting and some brokerage. The bonds, currencies, stock index futures, and crude oil futures continue to provide a great deal of opportunity and, concurrently, fear. The moves, both up and down, continue to be quite large and very, very fast. Truly life in the fast lane, given the leverage employed.

Hopefully, in forthcoming issues we will have 10th reunion news, gathered with some help. Imagine, ten years have elapsed since we became alumni.—**Arthur J. Carp**, Secretary, 110-07 73rd Rd., Forest Hills, NY 11375, (718) 544-5136

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Let's start this month's column with some of the class's over-achievers: How about starting with **Dan Zwilling**, who is an assistant professor at RPI and just got a contract to write the book *Handbook of Differential Equations* to be published early next year by Academic Press. Dan spent a recent vacation in Central America—Mexico, Belize, and Guatemala, where he was ordered out of a bus at gunpoint by the military. ... After years of crazy notes from psychiatrist-in-training **Lloyd Benjamin**, he now assures us, "Phew! Anyhow, I'm doing O.K." He details some of the reasons: "After completing my psychiatry residency this year, I'll be staying on as faculty, part of which entails assuming the awesome role of assistant director of residency education." Lloyd also reports (without details) that he will be married this June. ... **David Levens** and **Paul Okunieff** are both chief residents in their specialties. David practices general surgery at Montefiore Hospital in the Bronx, and will be starting a plastic surgery program in July. His wife (of two years) Linda is now associate director of program planning for CBS Sports. Paul is chief resident in radiation medicine at Mass. General Hospital. In his spare time he helped raise \$80,000 for hunger charities by climbing Mt. Kilimanjaro in Tanzania (elevation 19,340 feet). ... **Jose Flores** has just

started at Kennedy Space Center in Houston doing research in aero-space medicine.

And now a wholly different kind of achievement—babies, and boy do we have a bundle-full. **Yaneer Bar-Yam's** daughter Shlomiya is one-year-old. (Yaneer is working at the M.I.T. Physics Dept.) . . . **Phil Bugnacki** and his wife have both a boy and a girl. (Phil is still with FCI, but has moved back to New England—Northborough, Mass.) . . . One-year-old Elizabeth Ivester lives in Santa Clara, Calif. where her father **Jonathan Ivester** works as a production control supervisor at Applied Materials. . . . **Ellen Katz's** and **Jay Werb's** YUBBIE (Young Urban Baby) Julia is now two-years-old. Her mom (equipped with a new M. Arch. from M.I.T.) works as a designer with the Boston firm, Design Guild; dad after graduating from Sloan is a co-founder of a mysterious software consulting house in Cambridge. . . . **Katherine Richardson** and her husband Frank, '77, have a one-year-old daughter. Katherine has a Ph.D. in molecular genetics and is working on a post doc.

From **Doug Ruby**: "I got my Ph.D. in physics from the University of Illinois in October 1985. Now, I'm happily working in the solar energy department at Sandia National Labs (Albuquerque) on high efficiency compound semiconductor solar cells. My wife Karen and I are eagerly looking forward to the birth of our first child in June."

. . . **Mike Harlan** wrote to tell us about his recent wedding (February 16) and honeymoon. Mike met his wife, Sarah Ann Harrow, (formerly of Pittsburgh) while singing in the Stanford University Choir. (Mike was working on his M.B.A.; Sarah on her B.A.) They had a small wedding in L.A. and then travelled to Venezuela, "where we soaked up Caribbean sun and delved into the jungles to see the world's tallest waterfall. Now we're ready to get back to work and settle into the new home we've recently bought here in Sierra Madre, Calif."

More weddings: **Bob Asher**, now living in the Boston area, announced his May marriage to Linda Silverman. . . . **Armen Kasabian** and Jan Carroll were married late last summer. . . . **Carolyn Morrow** wrote to us from Palo Alto, Calif. to announce her marriage to classmate **Michael Rowen** last August, here in Cambridge.

Dave Schlegel writes: "Alive and well and skiing in Utah. Working in computer graphics at Evans and Sutherland, having finished my masters in computer science at University of Utah. I'm hoping to avoid more school in the future."

. . . **Bob Tatz** is working on a post doc in chemistry at Ohio State. . . . **Robin Schlinger** recently threw a house warming party, having moved into a new town house. Attending were **Pat Brown** and husband Tom T.D. Davidson, '77, and **Fern Krandall** and her husband Tony. Robin is still working for Mobil, and has recently been promoted to planning analyst. . . . From **Gayle Ehrenhalt**: "Just bought a townhouse; dreading paying the mortgage." Don't we know. . . . **Peter Sinclair**, having made his way with two high-tech firms, has now gone out on his own into the world of the entrepreneur.

M.I.T. has now established its 36th intercollegiate varsity sport: men's volleyball. And who better to coach it than **Karyn Altman-Velazquez** (who, in her first year as M.I.T. women's volleyball coach, was NCAA coach of the year in her division)? . . . A note from **Geoff Baskir**: Still at Dallas-Fort Worth Airport (five years in June) and living in Arlington with my wife Genie. I spend my spare time playing volleyball at the Jewish Community Center, running, and trying to save a local radio station from the clutches of the FCC. 'Sticles' retired in 1985 after a ten-year run, but I still draw on occasion."

All of which brings us to me. Not much has changed since last column. I'm still doing (and enjoying) planning analysis for University Hospital in Boston, learning the mysterious inner workings of a modern urban teaching hospital. Yuko (my wife) and M.I.T. are still conspiring to consume most of my salary in tuition costs (so please

give generously—and quickly—to M.I.T. scholarship funds).

Drop me a line (or a boring postcard) with news, sports or weather forecasts. anything at all. It'll give me something to read while Yuko is doing her homework (seven courses!!!).—**David S. Browne**, Secretary, 50 Follen St., #104, Cambridge, MA 02138

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Greetings, classmates. I regret to announce the death of **James M. Hagadus** on July 15, 1985. I know nothing about the circumstances of his death or his activities during the last six years, other than that he had obtained a doctorate. If anyone can provide any information, we would all be grateful.

I spoke to my good friend **Eileen Mannix** recently. Eileen is still a homeowner in Richmond, Vir. (home of the Confederacy) and enjoys her job in the hazardous wastes division of the Department of Health of the Commonwealth of Virginia. Eileen broke both ankles last year (in two separate incidents) but is happily on the mend (although she may have to give up her dream of stardom as a tap dancer). . . . **Jeff Ingerman's** wife dropped me a line to let me know about the birth of Jason Scott on December 29, 1985. Jason was a whopping 9 lbs. 2 oz. Big sister Jennifer is 2 and a half years old. . . . **Carol and James Rosen** announce the birth of their son, Alexander Michael, last November 26.

This month's prize for Most Admirable Ambition goes to **Leroy Lindquist**, who writes, "Since leaving M.I.T., I've been working on developing a personality." Good luck, Leroy, and let us know if you make it. . . . **J. Michael Amadeo** leads a double life: by day, he programs for "Index Technology" in Cambridge, while by night he plays original music, both as a soloist and with a band. . . . **Carl Ruoff** will be working for Andover Controls Corp. He plans to graduate from Suffolk Law School in June '86.

News of some doctors (M.D.s and Ph.D.s).

Robert Gompf is now an assistant professor of mathematics at University of Texas, Austin. . . .

Kenneth Burke is finishing his third year of residency in pediatrics at Yale-New Haven Hospital. . . .

John Becker is married and is a family practice resident in St. Paul, Minn. . . . **Elaine Imoto** is completing her three-year internal medicine residency at Kaiser Hospital in San Francisco and will start a three-year pulmonary fellowship at Stanford in June 1986. . . . **Eyad Abed** received his Ph.D. in electrical engineering from University of California, Berkeley in 1982, and has been an assistant professor of electrical engineering at University of Maryland, College Park, since 1983. . . .

Lann Salyard is a second year psychiatry resident at Medical College of Pennsylvania-EPPi (Eastern Pennsylvania Psychiatric Institute). Lann writes, "Currently, my patients are people who are hospitalized under court order and are very eager to be released. It keeps things very interesting! I'm also enjoying cross country skiing and aerobics!"

Keith Reid writes, "Believe it or not, I'm back in school! Not your everyday, run-of-the-mill school. I'm studying to be a medical evangelist under the auspices of Uchee Pines Institute in Seale, Ala. Some of you nutrition majors may have heard of Dr. Agatha Thrash and her husband, Dr. Calvin Thrash, who started this place in the early seventies. We work very closely with the Country Life vegetarian restaurants around the world—two in New York City and one soon to be set up in Boston's financial district. Please drop me a line at Rt. 1, Box 472, Seale, AL 36875."

Edward Hunter writes, "Since last we met, I've kept pretty busy. It looks like I've made California my home. I graduated from Berkeley in 1984 with a master's degree in computer science. I then went to work for Sun Microsystems in their systems group working on new products. For

those who don't know, Sun makes computer workstations for engineers. In my spare time I still do theater with the Gilbert and Sullivan group at Stanford (where I've run into a number of M.I.T. Musical Theater Group types: David Gaunt, '83, David Serafini, '83. I have also had time to get a pilot's license. Also, I'm sharing a house with three other M.I.T. people: Fred Tou, '81, Ivan Tou, '82, and Dennis Lee, '80. It's almost like never having left Boston, except the weather is better. If anyone I know gets out this way, they should drop by and say hi. We can go fly somewhere for lunch!"

Got a nice long letter from **Mike Fischbein**. "As you may remember, I was Navy ROTC and ended up in the surface nuclear program. I finished my two-year tour on *Carl Vinson* and passed my technical qualification as chief engineer for a multi-reactor ship. In 1983 I received orders to U.S.S. *Virginia* (CGN-38), a nuclear-powered, guided-missile cruiser. We were on deployment with the Sixth Fleet and we spent several months on the gun line, providing artillery support to the multinational force in Beirut. When we returned, I received temporary orders to the staff of exercise Ocean Venture 84. A few months after the conclusion of the exercise and my return to *USS Virginia*, I made the decision to leave active duty. I departed active duty on April 30, 1985. I took a brief vacation, and started trying to break into the independent computer consultant business while looking for a more permanent position. Eventually, I found a great job. I am currently working on the Numerical Aerodynamic Simulator computer networking project at the NASA Langley Research Center in Hampton, Virginia—and having a fantastic time (finally up to date!). I decided to remain in the Naval Reserve, and drill at the Fire Control Directorate (the people who design and maintain the programs of the weapons control and C³ computers) in Virginia Beach. Although I was positive I would not return to Newport News after spending a tour of duty in the shipyard, here I am. I just can't describe how much I like what I am doing! I hope everyone else in our class finds employment they enjoy as much as I do mine."

Bonnie Mason added the following to the information about her in last month's column: "I recently got promoted at Wang to senior manufacturing business consultant, whatever that means!" . . . **Christiane Tellefsen** married Barry Zimmerman in October 1985. He has his own company, General Lighting Corp., in Baltimore. M.I.T. alumni present at the wedding were Jon Claudemans, '80, and his wife Jennifer, Kevin Campbell, '80, and his wife Becky, and Nancy Everds, '78. I still have another year before I finish my residency in psychiatry here, and after that—?" . . . **Joel Feldman** was a speaker last winter at a conference called "Digital Signal Processing and Programmable Single-Chip Processors: Theory, Design, and Applications," sponsored by DSP Associates. Since April 1984, Joel has been with Kurzweil Applied Intelligence, where he now works on a team to develop the first 10,000-word speech recognizer. Prior to that, he worked at the Speech Systems Technology Group of the Lincoln Lab.

For those of you discouraged by the time it takes for information to reach these pages, be advised that it takes about six months for notes that you submit with donations to the Alumni Association to be published (about two months to reach me, then another four for publication). You can shave two months off by writing to me directly (besides which I'll mention you earlier in the column too!). I'm starting to sound like a PBS pledge break, so until next time . . . **Sharon Lowenheim**, Secretary, 303 E. 83 St., Apt. 24F, New York, NY 10028

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John Hainsworth writes that he is "alive and well and studying for a masters degree at Stanford."



An optical disc that holds 500 megabytes of data (240,000 pages of text)? Michael Howard, '84 (left), and Matthew Prete, '82, wrote the software used to retrieve the information from the disc and allow the user to manipulate it. They work for Datext in Woburn, a subsidiary of Cox Enterprises.

Four discs hold business information on some 10,000 U.S. companies. The product was introduced in January and is selling quite well, reports Prete.

... **David Debelliss** is working for Rocket Research Co. in Redmond, Wash. He says, "Seattle is a fantastic city, although it does rain quite a bit. Enjoying the laid-back lifestyle of the Pacific Northwest." ... **Canh Viet Le** received his M.B.A. from Kellogg School of Management at Northwestern. He's working for Salomon Brothers in New York City as a fixed income trader. He says **Sarah Sprung** is also working there.

George and Susan Burgess are working in Silicon Valley, Calif. George does signal processing at Lockheed Missiles and Space. Susan is a software engineer writing chemical instrument applications at Spectra Physics. They spend their free time traveling to such places as California, Utah, Arizona, Oregon, Hawaii, Switzerland, Austria, and Alaska. What a travel log!

Patrick Houghton decided to leave Procter and Gamble and try his luck at the Stanford Business School. He will be a finishing up his second year and is looking forward to getting back to the working world. ... **Tanya C. Sienko** is currently enrolled in the doctoral program in physics at the University of Illinois at Urbana. ... **Mindy Garber** decided to go to Stanford graduate school. She recently completed her master's in engineering (April 1984) and has been working for AT&T in "exciting" Piscataway, N.Y. ever since.

Rhonda Peck will spend the summer working on Wall Street for Goldman, Sachs & Co., which is about as far as you can get from starting a rock and roll band. Is this what old age does to you? So until September 15, write to my temporary address listed below.—**Rhonda Peck**, Secretary, 888 Middle Neck Rd., Great Neck, NY 11024

84

Surprise! Peter has decided to take an extended vacation in Tunisia, North Africa, to work on the "perfect tan." (Actually, he is currently working for that multinational company, Schlumberger, as

a field engineer. We wish him good luck.) He decided to let a couple of amateurs be the first in a series of guest columnists. And jumping right into it. ... **Terry Tatad** writes, "I have decided that grad school is not for me and therefore I am leaving Stanford with a master's degree in materials science. I am now job-hunting in the S.F. Bay area and looking forward to finally having some money to spend." She also passes on that **Nancy Beckman** occasionally visits us here at Stanford. She is working for IBM, San Jose. Another **McCormick 5 Wester**, **Lisa Tener**, is alive and well in San Francisco working for PG&E."

One night we ran into three more class of '84s—**Dave Chiang**, **Bill Lee**, and **Andy Litman**—who apparently did not get enough of each other at M.I.T. and are now living together in a house in Menlo Park. Dave works for Fairchild Research Lab in Palo Alto on high-speed bipolar RAMs. Bill is working for Facter/EDA (a subsidiary of Schlumberger) programming for design and test stations. Andy is at Xerox office systems and is pursuing a master's degree in computer science at Stanford. They mention that **Jim Lutz** is working for Sentry in marketing in San Jose. They also say **Ira Leventhal** is still with Hewlett-Packard and recently modelled in a fashion show at the Sunnyside Hilton in a Miami Vice outfit. ... he's still awaiting for lunch with Marlene Downs."

I recently hosted a Burton House brunch for a bunch of Bay area graduates. About 30 people showed up from the last five years and swapped information. Some highlights: **Robyn Coleman** is working as an engineer for Eaton Corp. in San Jose; **David Pope** is working for SRI International in Menlo Park; **Jackie Whang** is working for California Biotech Inc.; **John Jurus** is working for Watkins Johnson in Palo Alto; **Betty Beitz** is working as a process engineer for IBM San Jose; and **Tom Ransohoff**, not a Burton person, is also not working. He is getting his master's degree in chemical engineering at University of California, Berkeley, in June and is looking for a job.

Bill Mohr, who is still here in California in quest of the Stanford Ph.D., gives us these tidbits: "**James Camou** lives on a 30-ft. yacht in Marina del Rey and does GAs for TRW. ... **Pam Kee** has moved to Seattle to work for Boeing in the same plant as Gregg Lobdell, '85. ... **Audrey Dow** feels at home now in Michigan where GM takes the daytime hours." Another '84 working for GM is **Andy Leuzinger**, who graduated from Stanford with a master's degree in industrial engineering. ... **Alfredo Tamura** received his master's in mechanical engineering from UCLA and is going to Japan to work for NEC central research labs. ...

Our good friend from Portland, **Grace Tsang**, is currently working for Tektronix in device modelling. Another northwest classmate is **Eric Backus**, who is working for Hewlett Packard in Everett, Wash. ... Going on to the midwest, **Chunka Mui** is working on commercial applications of artificial intelligence for Arthur Anderson Inc. in Chicago. He is busy jetting to exotic locales like Boston, San Francisco, Dallas, and Albany, N.Y. He has gotten his black belt in karate and is wondering why nobody ever writes. ... **Heidi Brun** wrote and says that she is working in Boston and staying busy playing the flute in the M.I.T. band. ... **Ed Oh** has graduated from Stanford with his master's in chemical engineering and is working for Air Products in Allentown, Pa.

Chuck Kaprielian informed us that he is employed as a structural analyst in Stratford, Conn. He and **Brian Schultz** will be going down to watch the good ol' boys race in the Miller 500 at the Pocono national raceway in June. ... Both **Sheena Murphy** and **Armand Rosenberg** are working towards their Ph.D. in physics at Cornell. ... **Kathy Takayama** is studying for her Ph.D. in biology at SUNY/Stony Brook and says that Peter did not have it right in the last issue, that is **Michelle Heng** had the first baby in our class last June. ... **Franklyn Turbak** is still at M.I.T. pursuing a Ph.D. in computer science. ...

As for the authors of this "fabulous" column, **Sho Fuji** and **Mona Wan**, we have both been lured from the ivory tower of academics by visions of fame and fortune (and stock options) to join start-up companies. Sho will be leaving Stanford in June to join a GaAs start-up called Gain Electronics Corp. in central New Jersey. Mona left Stanford last June to start working for a thin films start-up called Reche Corp. in Mountain View, Calif. If anyone wants to let us know how or what they are doing, they can drop a line to Mona. I believe that our next columnist shall be our class president, **Diane Peterson**.—**Mona Wan**, Acting Secretary, 12231 Viewoak Dr., Saratoga, CA 95070

85

Hey dudes! Lately I've seen all sorts of '85ers around campus—mostly in the career planning office. **Dave Douglas** is looking to stay in the Boston area, I don't know where yet. I've also run into **Cindy Paschal**, **Libby Patterson**, **Gaile Gordon**, **Josh Marantz**, and **Jeff Lanier**. Jeff is working at Draper labs and the others will be graduating soon with masters degrees. **Dave Rose** has defected from course VI to Sloan school and will receive his M.B.A. this June. Other defectors are **Aaron Wang** and **Michael Lyons**, both of whom I believe are also finishing in June. **Lora Silverman** is also still in Boston. She's been very busy helping to determine the class of '90 in the admissions office.

I've been living with **Paul Mansky**, '85, and **Anna Lisa Fear**, '85 in Somerville. Anna Lisa will receive degrees in biology and literature. She plans to work in the Boston area. Paul graduated in January and is hanging out until he begins his graduate study in the physics department at Princeton. In the meantime he is working as a waiter in Harvard Square, hoping to be discovered by a famous physicist who will become his mentor. He has been breaking womens' hearts and hopes to make it to Europe this summer to break some more hearts.

Like Paul, **Jeff Winner** also graduated in January; unlike Paul he has not been breaking any hearts. Jeff is working at Schlumberger in Palo Alto while he earns a Ph.D. in electrical engineering at Stanford. Also like Paul, Jeff is my roommate. ... We bought a house in Santa Clara with Jay, '83 and Donna Keith. Steve Carroll, '84, a dog, cat and chinchilla are also living with us—I'm sure we have room for more, so if any of you are in the San Francisco area just let me know! **Carl Linde** and **Todd Tsakiris** dropped by. Carl lives in the area and Todd was interviewing with a few companies.

Inge Gedo gave me a call the other night from Dallas—where she is currently located. By this time she will be in Germany at the Air Force Intelligence school. **Roberto Engels** is also overseas. He is working in Brazil as a research analyst for Booz, Allen & Hamilton. He loves the job since "working in consulting entitles him to see many aspects of the industry and management world." Also, he has been promoting M.I.T. abroad as a member of the educational council.

Samuel Lafontaine is designing machine tools for TRW Inc., presumably in southern California. And, since my mailbox was not overflowing this month, while I was at the National Security Agency I checked into what some of you are up to! **Michael Gambello** is working on a M.D./Ph.D. at Rochester University Medical School. **John-Paul Brand** is in graduate studies at M.I.T., and **Jon Morrow** is in Canada studying medicine at McGill. Further west, **Cathy Gerhig** is at University of Arizona at Tucson working towards her Ph.D. in chemistry. **Susan James** is also studying chemistry; she's at Berkeley.

Well, I don't know when I'll get a chance to drop by the NSA again, so please let me know what's happening in your life and your friends' lives!—**Stephanie Scheidler**, Secretary, 3511 Shafer Dr., Santa Clara, CA 95051 (408) 985-6651

I CIVIL ENGINEERING

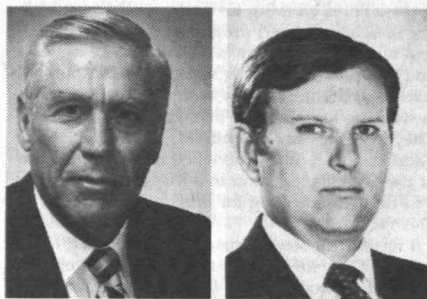
Engineering Systems and Computation, a new educational track, will be offered by the department at M.I.T. beginning next fall. It's planned for students who want a broad knowledge of engineering-based systems and computation, focusing on software and analytical tools for dealing with large and complex engineering issues.

Professor **Joseph M. Sussman**, Ph.D.'67, who left his administrative assignment as head of the department at M.I.T. a year ago, now has a new one: he's director of M.I.T.'s Center for Transportation Studies. Sussman had done pioneering work on computation applied to transportation systems analysis, especially on rail freight systems. As CTS director he succeeds Professor **Daniel Roos**, '61, who last year became the first director of a new M.I.T. Center for Technology, Policy and Industrial Development.

Associate Professor **Wallace K. Melville** of M.I.T. has won a Guggenheim Fellowship for 1986 to support research on ocean waves. . . . **Michael A. Collins**, Ph.D.'70, reports that since 1984 he has been director of the Center for Urban Water Studies at Southern Methodist University, Dallas, and in 1986 became associate chairman of the Civil and Mechanical Engineering Department. . . . **David N. Deleuw**, S.M.'81, with Michael Baker, Jr., Inc., Jackson, Miss., was selected the state of Mississippi's "1985 Young Engineer of the Year." . . . **Eric P. Maille**, S.M.'84, was promoted to department head—economic forecasting and analysis in the Corporate Planning Department at Hydro Quebec.

Air Force Lieutenant Colonel **Theodore P. Yurkosky**, S.M.'69, chairman of the Department of Obstetrics and Gynecology with the U.S. Air Force Medical Center, West Germany, has been decorated with the Meritorious Service Medal. The award recognizes individuals "for outstanding non-combat achievements or service to the United States." . . . **John E. Isbell**, S.M.'74, a structural engineer since 1984 at Sear-Brown Associates, P.C., Rochester, N.Y., has been named an associate of the firm. . . . **Thomas S. Maddock**, S.M.'51, president and chief executive officer of Boyle Engineering Corp., Newport Beach, Calif., received an Outstanding Engineer Merit Award from the Institute for the Advancement of Science last February 21. Maddock was recognized for his technical expertise on water resource matters and for his role as "a recognized expert in organizing the institutional arrangements for financing and implementation of major water supply projects."

Steven M. Luscinski, S.M.'76, has been promoted from vice-president and chief financial officer to executive vice-president/general manager of Accu-Sort Systems, Telford, Penn. Luscinski is responsible for all company operations, day-to-day management, as well as various planning functions. . . . **Arthur C. Ruge**, Sc.D.'33, who taught civil engineering at M.I.T. from 1932 to 1947 was named the 1986 "New England Inventor of the Year." Ruge's most popular invention (developed



T. S. Maddock

S. M. Luscinski

in an M.I.T. laboratory) is the SR-4 Strain Gage, which is used worldwide by all commercial weighing scales. Ruge holds 56 U.S. patents and many more abroad. Among those are patents covering the strain gage that were first offered to M.I.T. in 1939; but the M.I.T. Patent Committee declined, thinking that commercial applications are "unlikely to be of major importance."

II MECHANICAL ENGINEERING

A new honor for **Ernest G. Cravalho**, for the past ten years Matsushita Professor of Mechanical Engineering in Medicine at M.I.T. He has now been designated the first Edward Hood Taplin Professor at Massachusetts General Hospital, where he will be chief of biomedical engineering. The professorship, established by **John F. Taplin**, '35, and his family, links M.I.T., Harvard, and M.G.H., expressing the Taplins' interest in developing of new kinds of health professionals—medical engineers and physicists who apply their skills in a clinical setting as peers of physicians. Cravalho is such an engineer—an expert in applying cryogenic engineering to biology and medicine and, more recently, in applying fluid dynamics to phenomena in the lower urinary tract.

Professor **Ascher H. Shapiro**, '38, retired last month after nearly 50 years at M.I.T. Shapiro was honored early in May when more than 150 friends, colleagues, and former students announced a fellowship in Shapiro's name, a tribute to "his monumental contributions to M.I.T. and fluid mechanics through teaching, research, writing, and films."

Harvey Kaye, '65, a consulting engineer of Amherst, Mass., has written *Launching and Building Your Independent Practice* (Wiley, \$19.95, 1986). Kaye discusses what it takes to be a successful consultant, giving instruction on launching and building practices and helping technical professionals make their unique skills pay off. . . .

Philip S. Blackman, S.M.'69, writes of his recent activities, "Developed the command and control master plan for headquarters Third United States Army . . . generated various proposals for use of computer graphics in battle management." . . .

James R. Bledsoe, S.M.'62, recently changed jobs; he is now senior product development engineer with Saginaw Machine Systems, Troy, Mich.

III MATERIALS SCIENCE AND ENGINEERING

T. David Burleigh, S.M.'80, a post-doctoral associate in the department at M.I.T. is now in West Berlin under a one-year Alexander von Humboldt Research Fellowship. . . . **William A. Krivsky**, Sc.D.'54, president and founder of the Keyson Co., Inc., Bedford, N.H., a general management consulting firm, was presented the Robert Earl McConnell Award of the American Institute of Mining, Metallurgical and Petroleum Engineers at its 115th annual meeting last March. Krivsky was cited for "his pioneering work in the development of the argon-oxygen-decarburization process, resulting in higher quality stainless steels and in the conservation of minerals."

After three years as professor of materials science and engineering and chair of the Mining, Metallurgical and Ceramic Engineering at the University of Washington, Seattle, **Richard C. Bradt**, '60, has been named to the Kyocera Corporation Professorship in the university's Department of Materials Science and Engineering. . . . **Ralph G. (Gil) Gilliland**, Ph.D.'68, has joined Alcoa Laboratories, Alcoa Center, Penn., as operations director for advanced manufacturing R&D. Formerly Gilliland served as vice-president and general manager of Lukens, Inc.

William J. Knapp, Ph.D.'42, professor of materials science and engineering at the University of California, Los Angeles, died as the result of a hit-and-run accident near his home in Los Angeles on January 15, 1986. In memory of Knapp, the university established the William J. Knapp Scholarship. "As you know, besides his family, Bill's life was the university and especially the students. For 40 years, he gave so much of himself to countless numbers of young students," said Professor John D. Mackenzie, a colleague in the department. . . . Rear Admiral **Herman A. Pieczentkowski**, S.M.'40, (U.S.N. Ret.) of Coronado, Calif., passed away on July 31, 1985; no further details are available.

IV ARCHITECTURE

Worldwide development trends that have implications for facilities development will be the focus of new research in the Laboratory for Architecture and Planning under a five-year, \$500,000 grant from Shimizu Construction Co., Ltd., Tokyo. Specific areas of interest: communications and regional development; impact of new materials on construction industries; macroengineering; and major demographic and economic trends influencing facilities construction. **Michael L. Joroff**, director of the laboratory, will be program director. Shimizu is Japan's major construction company.

John Messina, M.Arch.'77, a former faculty member at Boston University, has relocated to Tucson, Ariz., to join Architecture One, Ltd., as senior designer. In his new position, Messina is working as lead designer for a 34-acre complex of office, industrial, and hotel space (the Sunbelt Commerce Center). . . . **Roger K. Lewis**,

M.Arch.'67, architect, author, columnist, and faculty member at the University of Maryland's School of Architecture, has been admitted to the College of Fellows of the American Institute of Architects, cited for his accomplishments in education, literature, and design. Lewis' column "Shaping the City" appears weekly in the *Washington Post*, and his recent book *Architect? A Candid Guide to the Profession* (M.I.T. Press, 1985) is currently being adopted as a basic college textbook.

Kimberly A. Weller, M.Arch.'80, has been named an associate of Architects for Health, Science, and Commerce, Inc., White Plains, N.Y. For the past few years, Weller has served as a project manager, working with Mt. Sinai Medical Center and the Hospital for Special Surgery in New York City. . . . **Richard D. Rush**, '67, a registered architect and consultant in Arlington, Va., and former senior editor of *Progressive Architecture*, is editor of *The Building Systems Integration Handbook* (Wiley, November 1985). The text, a project of the American Institute of Architects, contains contributions from over 100 building and design experts. It's the only book that "essentially takes a building apart piece by piece and looks at all the aspects of integration for system and products used by today's top professionals," says its publisher.

Nezar Alsafad, M.Arch.'81, writes, "I have left my position as assistant professor of architecture at the University of Petroleum and Minerals in Dhahran, Saudi Arabia. Presently, I am a visiting lecturer in the City and Regional Planning Department at the University of California, Berkeley."

V CHEMISTRY

Thomas R. Gilbert, Ph.D.'71, associate professor of chemistry at Northeastern University, Boston, was a candidate for chairman-elect of the Northeastern Section of the American Chemical Society, with members' ballots due June 1. His "platform" proposed that "chemistry has an image problem"—too much awareness of problems, too little of the accomplishments of chemists. "The ACS," says Gilbert, "is in an excellent position to project a clearer, more complimentary image." **James U. Piper**, professor of chemistry at Simmons College, was unopposed for the post of treasurer of the Northeastern Section for 1986-87.

To **H. Eugene Stanley**, Ph.D.'49, director of the Center for Polymer Studies at Boston University: B.U.'s Macdonald Award for applications of mathematical analysis to complex structures in polymer physics. . . . Assistant Professor **Sylvia T. Ceyer** of M.I.T. was honored last spring with a \$25,000 research fellowship from the Alfred P. Sloan Foundation. As a scientist of "extraordinary promise," she can use the funds for whatever research is of most interest to her.

Professor **Robert J. Silbey** holds the 1986 M.I.T. School of Science Award for distinguished teaching, cited as a "sensitive and perceptive instructor (who) conveys enthusiasm and excitement for the field of physical chemistry."

Ronald Francis, Ph.D.'64, a faculty member in the new Center for Imaging Science at Rochester Institute of Technology, has been named RIT's first Frederick and Anna B. Wiedman Professor in Imaging Science. The Professorship recognizes Francis as a leading scholar and outstanding teacher in the field. . . . **Robert B. Frye**, Ph.D.'76, is manager of product research for the Silicone Products Division of General Electric, Watford, N.Y.

Lester N. Stanley, S.M., '32, a research chemist for 29 years at the G.A.F. Corp., Delmar, N.Y., passed away in Venice, Fla., on February 17, 1986. Stanley, who held more than 60 U.S. patents on dyes, was a 50-year member of the American Chemical Society, a member of the Oriental Temple of Troy (N.Y.), and a Shriner with the Venice chapter, and a Mason.



R. G. Gilliland

K. A. Weller

VI ELECTRICAL ENGINEERING AND COMPUTER SCIENCE

To **James L. Flanagan**, Sc.D.'55, director of the Information Principles Research Laboratory at AT&T Bell Laboratories, the 1986 Gold Medal of the Acoustical Society of America "for contributions and leadership in digital speech communications." Flanagan has been with Bell Laboratories since 1957; he was director of its Acoustics Research Department from 1967 to 1985.

Bruce R. Musicus, Ph.D.'82, is now the Rockwell International Career Development Assistant Professor in the department at M.I.T. He's the first occupant of the new chair endowed by Rockwell International of Pittsburgh, Pa. Musicus was chosen on the basis of his "outstanding contributions in the design of software and hardware for digital signal processing."

Thinking Machines Corp., of which **Sheryl L. Handler**, '76, is president, made a publicity splash early this spring in Cambridge by announcing its first major product—a \$1 to \$3 million supercomputer called the Connection Machine. **W. Daniel Hillis**, S.M.'81, architect of the machine, did his doctoral thesis with Professor **Marvin Minsky** at M.I.T., who is also a founding scientist of the company.

IEEE has elected four members of the M.I.T. community to the grade of fellow:

- ☐ **Carlo J. DeLuca**, senior lecturer in mechanical engineering, for contributions to recording, analysis, and applications of myoelectric signals.
- ☐ **Jae S. Lim**, '74, associate professor of electrical engineering and computer science, for contributions to speech and image enhancement through digital signal processing.
- ☐ **Bruce D. Wedlock**, '58, director of the Lowell Institute School, for leadership in electrical engineering education.
- ☐ **Alan S. Willsky**, '69, professor of electrical engineering and computer science, for work on the theory of estimation and detection in stochastic systems.

Raphael C. Lee, Sc.D.'80, assistant professor in the department at M.I.T., is the first holder of the new Karl Van Tassel Career Development Professorship. Lee's field is the impact of electrical and mechanical stresses on the human body, and Van Tassel (M.I.T.'25) has designated his professorship for research "on the cutting edge of biomedical technology."

A change in command at MITRE Corp.: **Robert R. Everett**, S.M.'43, retired as president on July 1, to be succeeded by **Charles A. Zraket**, S.M.'53. Zraket has been with MITRE since it spun off from M.I.T.'s Lincoln Laboratory 25 years ago, and he's been executive vice-president and chief operating officer since 1978.

A new research project proposed by **Harrison F. Rowe**, S.M.'48, Anson Wood Burchard Professor of Electrical Engineering at Stevens Institute of Technology, Hoboken, N.J., has been funded by the Defense Department's Office for Innovative Science and Technology. Rowe's research "will determine the feasibility of using passive radio sensors for the surveillance, acquisition, and tracking of launch vehicles and their payloads."

. . . **Bernard Widrow**, Sc.D.'56, professor of electrical engineering at Stanford University, has been

awarded the 1986 Alexander Graham Bell Medal by the Institute of Electrical and Electronic Engineers for "exceptional contributions to the advancement of telecommunications."

Bhag C. Jain, Sc.D.'75, general manager of the Energy Division of Jyoti Ltd., Vadodra, India, spent three months in the U.S. last spring as the recipient of an Eisenhower Exchange Fellowship. As an expert in renewable energy resources, Jain visited many U.S. sites—including several days at M.I.T. Before coming to the U.S., Jain was re-elected president of the Renewable Energy Equipment Manufacturers' Association for a three-year term.

Three deaths have been reported to the Alumni Association, with no further details available: **Edward V. Powell**, '32, of Marstons Mills, Mass., on February 16, 1986; **Captain Clyde L. Olson**, S.M.'50, (USCG Ret.) of Alexandria, Va., on December 4, 1985; and **Bertram Wellman**, S.M.'37, of Fort Meyers, Fla., in 1984.

VI-A Internship Program

The demand for admission to the VI-A Internship Program remains high. One percent more of this year's Course VI sophomores resulted in 192 applications. The final entering class, resulting from the 992 on-campus company-conducted interviews, will number 96. This will bring VI-A's academic 1986-87 enrollment to about 263, continuing the trend in reducing the Program to a more manageable level for our faculty.

Withdrawing from the program is RCA's Astro-Electronics Division, Hightstown, N.J. Assignments will continue at RCA's Sarnoff Laboratory, Princeton, N.J.; however AED will phase out as its currently enrolled students receive their degrees.

It is with great personal sadness that I report the death on April 30, 1986, of 90-year-old Professor (Emeritus) **Karl L. Wildes**, '22 whom many of you, I know, fondly remember. Professor Wildes came to M.I.T. in 1920. For part of his career here, Wildes served as Professor William H. Timbie's assistant in the administration of Course VI-A, and VI-A continued to be close to his heart in all his active years in the Department. Later he went on to advise many of our graduate students in his position in the department's graduate office.

Professor Wildes was instrumental in my own coming to M.I.T. in 1956. It was he who introduced me to Professor **Gordon S. Brown**, '31, then head of the department, who was looking for an assistant. Professor Wildes was a wonderful mentor to me, especially from the time I became VI-A director in 1969.

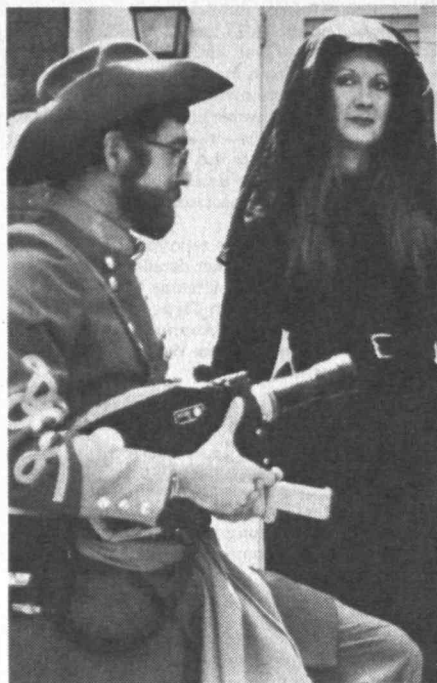
Karl's final accomplishment was the writing of the detailed 100-year history of M.I.T. EECS Department, in the final compilation of which he was assisted by co-author **Nilo A. Lindgren**, '48, himself a VI-A graduate. We will surely miss Professor Wildes' remarkable memory of events and activities making up the history of this prestigious department and the personal interest and pride he took from the accomplishment of its graduates.

VI-A's annual west coast picnic is scheduled for Sunday, August 10, 1986. Again this year, we will have the co-operation of the M.I.T. Club of Northern California. Alumni/ae are invited and anyone interested in attending should contact **John D. Chisholm**, '75, at (415) 854-2133.

As is not uncommon, several more honors have befallen VI-A graduates. **C. Gordon Bell**, '56, has been named as director of NSF's newly established Directorate for Computer Research and Information Science and Engineering.

Donald B. Sinclair, '31, who died last August, was honored by Life Members of the IEEE at a special luncheon in Boston on May 14 in connection with Electro/86. Don, a pioneer in amateur radio, rose to become chief executive officer of the General Radio Co. (now named GenRad).

Heading out to the East Garage one evening, I met **Andrew J. Eisenberg**, '79. Andy told me he



Ross McElwee, S.M.'77 (left), and three of the eight women he filmed during a sentimental journey through the South

For an unusual few weeks in November 1985, Bostonians had the opportunity to see two new films by M.I.T. graduates—*Return* by Andrew Silver, '77 (see January 1986, p. B13), showing at Copley Place, Boston's posh downtown theater-hotel-shopping complex; and *Sherman's March* by Ross McElwee, S.M.'77, playing at the Institute of Contemporary Art.

Sherman's March, subtitled *A Meditation on the Possibility of Romantic Love in the South During an Era of Nuclear Weapons Proliferation*, is a humorous and unusually personal exploration of modern love relationships.

McElwee, born and bred in Charlotte, N.C., originally set out to make a feature-length documentary retracing General William T. Sherman's devastating Civil War march to the sea and exploring its present-day effects on the South. McElwee was to act as both narrator and film crew.

But a few days before the shooting was to begin, McElwee's personal life crashed: his girlfriend announced she was leaving him for another man. Heartbroken and miserable, McElwee decided to take his portable camera and miniature Nagra sync-sound tape recorder and forge ahead with what promised to be a very lonely pilgrimage through Southern history.

When he arrived in North Carolina

Sherman's March: A Cinéma Vérité by Ross McElwee



in a new movie called *Sherman's March*: Claudia (left, with McElwee) and Ashley (above) preparing for a cos-



tume ball, and Pat, a third conquest (right). McElwee is now making a film on the Berlin Wall for fall release.

from Cambridge, his sister persuaded McElwee to alter the theme and use the film project to help him gain some insight into his past relationship. She convinced McElwee to use his camera as a "conversation piece" and a vehicle to meet women—filming all encounters.

On his journey McElwee becomes involved with eight women: Mary, a childhood sweetheart; Joy, a rock guitarist; Charleen, a friend and former teacher; Claudia, an interior designer; Pat, an aspiring actress; Wini, a linguist working on her dissertation; Jackie, a schoolteacher; and Karen, an attorney and ERA activist. McElwee is the only one behind the camera in his unrehearsed encounters with these women; he is able to capture each one's unique background and the occasional revealing moment—all in a natural, sensitive, and sometimes very humorous way.

Nor does McElwee entirely neglect Sherman on this journey. When inspired, he does take "time to reflect upon the paradoxes of Sherman's destruction of the South and upon America's military legacy."

McElwee produced, filmed, narrated, and recorded the sound for *Sherman's March* during the summer and fall of 1981. The movie took seven months to film and nearly three years to edit. He received funding from various sources, including a Guggenheim Fellowship,

WGBH-TV in Boston, and the Massachusetts Council on the Arts and Humanities.

The film, which is McElwee's seventh, has since been featured at Boston's Copley Place. It was picked up for release in Europe and featured at the Berlin Film Festival as well as on German television. Presently negotiations are being made for its New York release and presentation at other European film festivals. McElwee's other works—which include *Charleen*, *Space Coast*, *Resident Exile*, and *Backyard*—have been chosen for over 30 festivals and have received awards in the United States and abroad.

After graduating from the Rhode Island School of Design in 1971, McElwee traveled to Europe while working as a photographer's assistant. He began his film career as a studio cameraman for a Charlotte, N.C., television station, then honed his craft in public television. He entered M.I.T.'s graduate filmmaking program in 1975, working under Professors Edward Pincus and Richard Leacock to complete his first two films.

McElwee is currently a visiting lecturer at Harvard University's Carpenter Center for the Visual Arts. He just received funds from Boston's WGBH television to produce a half-hour film marking the 25th anniversary of the Berlin Wall, to be completed mid-summer.—Valerie Kiviat □

is now working for Computer Corp. of America located in Kendall Square. . . . A telephone call from **Bradford E. Hampson**, '75, tells us he's with Network Switching Systems, Inc., Andover, Mass. He lives in Westford and has two children. . . . **Thomas M. Jahns**, '73, was attending an M.I.T. conference in April when Director Tucker happened by. Tom is with corporate R&D at the General Electric Co., Schenectady, N.Y., where he did his VI-A work.

Donald S. Levinstone, '72, stopped by one day to have some job offers posted. Don is principal engineer with the Systems and Components Engineering Division of the Polaroid Corp., Cambridge. . . . **Andrew E. Moysenko**, '72, came by in April when attending the Molecular Beam Conference organized by Professor **Clifton Fonstad**, Ph.D.'70. He's now with Sanders Associates, Inc., Nashua, N.H. and maintains contact with M.I.T. as a member of the Educational Council helping in the selection of freshmen.

And lastly, VI-A Director John A. Tucker was honored by the M.I.T. Chapter of Tau Beta Pi for his 30 years as chief faculty advisor. The Chapter president, **David C. Martin**, '86, presented Mr. Tucker with an engraved plaque at the May Initiation Banquet held at the Sheraton Boston Hotel and Towers.—John A. Tucker, Director, VI-A Internship Program, M.I.T., Room 38-473, Cambridge, MA 02139

VII BIOLOGY

A National Arthritis Foundation grant has come to **Ky T. Lowenhaupt**, a postdoctoral fellow in the department at M.I.T. His work is a study of "Mapping of Chromatin Structure: Z-DNA Potential Sites."

Philip A. Sharp, director of the Center for Cancer Research, is the first holder of the Class of 1941 Professorship at M.I.T., established by members of the class at their 40th reunion. Sharp's selection was on the basis of "outstanding contributions to both education and scholarship in cellular and molecular biology," says **John M. Deutch**, '61, provost.

To Professor **Susumu Tonegawa**: the \$50,000 ninth annual Bristol-Myers Award for Distinguished Achievement in Cancer Research, for Tonegawa's discovery of the genetic basis of the immune system. Explaining the importance of Tonegawa's work in the M.I.T. Center for Cancer Research, Sharp said it "shows the immune response is a dynamic one, enabling humans to adapt to a changing environment . . . (and resulting in) a new way to look at diagnosing and treating diseases relating to it, including AIDS, certain cancers, rheumatoid arthritis, and multiple sclerosis."

Professor **Jonathan A. King** of M.I.T. is the winner of a Guggenheim Fellowship for 1986, awarded for research in amino acid sequences and protein folding.

VIII PHYSICS

Associate Professor **Alan H. Guth**, '68, of M.I.T. was one of four speakers on "Life and the Universe" during the 123rd annual meeting of the National Academy of Sciences at the end of April. The session was a review for members of the Academy of new information about the birth of the universe—Guth's specialty—and the diversification and evolution of life on earth. A week later Guth provided an invited paper on "The New Inflationary Universe" for the spring meeting of the American Physical Society in Washington.

To Professor Emeritus **Robley D. Evans** of Scottsdale, Ariz., the William D. Coolidge Award of the American Association of Physicists in Medicine, to recognize his contributions on measuring radium exposure and controlling radium hazards in industrial operations.

Two alumni of the department—**Solomon**

Buchsbaum, Ph.D.'57, and **Burton Richter**, Ph.D.'52—are members of a new Advisory Board to M.I.T.'s Lincoln Laboratory. Buchsbaum is executive vice-president—customer systems at AT&T Bell Laboratories, Richter director of the Stanford University Linear Accelerator Center. The new board will "provide advice on the research program of the laboratory and its future directions," says **John M. Deutch**, '61, M.I.T. provost to whom the Laboratory reports. Buchsbaum, was also elected to a major role in advising the Charles S. Draper Laboratory last spring: he is a director of its Draper Corp.

Sloan Research Fellowships of \$25,000 came to two members of the department at M.I.T. last spring: **B. Gabriel Kotliar** and **John L. Tonry**, both assistant professors. They are free to use the funds to pursue whatever research is of most interest to them, the Sloan Foundation said.

Kosta Tsipis, director of M.I.T.'s Program in Science and Technology for International Security, is co-editor of *Arms Control Verification: The Technologies That Make It Possible* (Pergamon-Brassey's International Defense Publishers, Inc., 1986); his co-editors are **David Hafemeister**, visiting scientist at M.I.T. in 1983-84 who is professor of physics at California Polytechnic University, and **Penny Janeway**, technical editor at the M.I.T. program. The book's thesis is that improved verification technologies have removed one of the major impediments to arms control agreements.

Mitchell J. Feigenbaum, Ph.D.'70, a theoretical physicist at Cornell University, Ithaca, N.Y., was the co-recipient of the Israel-based 1986 Wolf Foundation Prize in Physics. The Foundation is designed "to promote science and art for the benefit of mankind." Feigenbaum was cited for his "original theoretical work demonstrating the universal character of non-linear systems, which has made possible the systematic study of chaos."

. . . Testimony by **Solomon J. Buchsbaum**, Ph.D.'57, to the Senate Armed Services Subcommittee last December, advocating the viability of the SDI "Star Wars" program, appeared early this year in *Physics Today*. Buchsbaum admits that a totally fail-safe missile defense is unrealistic but on the basis of experience with the telephone network he believes that a system could be designed to be "reliable, robust, and resilient." Furthermore, "a large system could compensate for errors . . . the network as a whole is more reliable than its individual components," said Buchsbaum.

Professor **Herman Feshbach**, Ph.D.'42, former head of the department at M.I.T. who is nationally recognized in nuclear theoretical physics, received the National Medal of Science at White House ceremonies last March 12. Feshbach was cited for "his distinguished contributions to science as a nationally acclaimed leader in physics education . . . and his total commitment to scientific excellence."

IX PSYCHOLOGY

Effective July 1, the Department of Psychology at M.I.T. has been merged with the Neuroscience Program of the Whitaker College of Health Sciences, Technology and Management to form a new Department of Brain and Cognitive Sciences. Its head is **Emilio Bizzi**, Eugene McDermott Professor in the Brain Sciences and Human Behavior, who is also director of Whitaker College. Professor **Richard Held**, head to the Department of Psychology since 1977, will continue his teaching and research as a member of the new department. The idea, says **John M. Deutch**, '61, provost of M.I.T., is to strengthen the interdisciplinary approach to the complexities of the brain, combining "the experimental technologies of neurobiology and psychology with the theoretical power coming from the fields of artificial intelligence and linguistics." The work will be focused around two themes: computation and neurobiology. The former, says Dr. Bizzi, is a powerful unifying factor for work in the brain and cogni-

tive sciences; the latter, a key to new studies of the nervous system and the mechanisms of brain function.

To **William E. Cooper**, Ph.D.'76, professor of psychology at the University of Iowa, the biennial award of the Acoustical Society of America presented at the ASA's 1986 annual meeting in Cleveland last May. Cooper was cited for basic research on the phonetic attributes of speech, including speech and language disorders resulting from brain damage. At Iowa since 1983, Cooper previously taught psychology at Harvard.

X CHEMICAL ENGINEERING

Professor **Robert E. Cohen** of the department at M.I.T. is head of a new interdepartmental program in polymer science and technology in which ten students will begin graduate work next fall. The unified polymer curriculum has been developed by faculty in this department and chemistry, mechanical engineering, and materials science and engineering; topics covered range from the molecular level to the continuum view of polymers.

To celebrate the centennial of Arthur D. Little, Inc., the company and Royal Little, nephew of the company's founder, have together given funds for a professorship in the department at M.I.T., and **Robert A. Brown** is now the Arthur Dehon Little Professor of Chemical Engineering. Brown, a specialist in modelling fluid mechanics and mass transfer, came to M.I.T. from the University of Minnesota in 1979; he holds the department's Outstanding Faculty Award for 1980, 1983, and 1985.

Norman A. Jacobs, S.M.'59, is president and chief operating officer of Biotechnical International, Inc., Cambridge. Jacobs was formerly president of Amicon Corp., a division of W.R. Grace and Co. . . . **Robert E. Latimer**, S.M.'46, writes, "I continue full-time as a consulting cryogenic and chemical engineer, designing oxygen plants. For 24 days (April-May 1985), my wife and I toured Russia, Soviet Central Asia, Siberia, Mongolia, and China, including Irkutsk to Peking by train. I have a new AT&T 7300 computer for running the programs I write for air distilling columns at minus 300°F."

Peter C. Wayner, Jr., Ch.E.'60, professor of chemical engineering at Rensselaer Polytechnic Institute (RPI), Troy, N.Y., has been named a fellow of the American Institute of Chemical Engineers. Wayner joined RPI in 1965; he was cited for "his contributions to chemical engineering education and research in heat transfer, mass transfer, and fluid mechanics." . . . **William F. Beck**, Sc.D.'64, has been elected vice-president of FMC Corp., Chicago. Prior to this appointment Beck served as manager of FMC's Industrial Chemical Group, Philadelphia. . . . **James S. Bruce**, S.M.'39, reports, "I've been busy in retirement developing a computer simulation for the technical and financial decisions in moving a new product from research to market. It's currently in use in a course at the Center for Creative Leadership in Greensboro, N.C."

Frank R. Graziano, S.M.'77, is a manufacturing operations manager for the Industrial Chemicals Division at Procter and Gamble, Cincinnati Ohio. . . . **Austin W. Fisher**, Sc.D.'41, writes, "Fully retired, in good health, and living with wife Anne on our 31-foot sailboat on which we cruise for several months each year. Active in Coast Guard Auxiliary, U.S. Power Squadron, St. Croix Yacht Club, and, for a change of pace, the St. George Village Botanical Garden."

XI URBAN STUDIES AND PLANNING

John Blackwell, M.C.P.'47, is the managing director of a drive to create an independent "Fund for the Arnold Arboretum," in the Jamaica Plain area of Boston. The endowment fund is the work

A Childhood Dream Fulfilled Aboard *Columbia*

After the Soviet Union launched *Sputnik I* in 1957, a Costa Rican youngster wrote, in Spanish, to Wernher von Braun to ask how to become an astronaut. Franklin Chang-Diaz was very serious about his question, and the rocket scientist gave him a serious answer: Come to America and study science.

Von Braun's advice became Chang's dream. In 1968 he arrived in Hartford, Conn., from Costa Rica with the stub of a one-way airline ticket, \$50, and a small suitcase, ready to start his new life with relatives there.

Less than 20 years later Chang-Diaz had achieved his dream of space flight aboard the first 1986 flight of the shuttle *Columbia*. And his single-minded pursuit of that goal captured the attention of writers for both the *New York Times* and the *Boston Globe*. Profiles of Chang-Diaz appeared in both publications in January, while the oft-delayed *Columbia* fought technical problems and bad weather first to get off the ground, then to land.

After coming to the United States, Chang-Diaz had come to terms with English in time to graduate in the top 20 percent of his high school class in Hartford, won a scholarship to study physics and mechanical engineering at the University of Connecticut, completed an Sc.D. at M.I.T. in 1977, and gained U.S. citizenship.

In 1979 Chang-Diaz decided it was now or never, and he was one of 3,000 applicants to become an astronaut. Nineteen were accepted, and when the good news came, he was "in a daze for two days," he recalls.

Because he's technically only part Hispanic (his paternal grandfather fled his native China during the Boxer Rebellion), Chang-Diaz likes to emphasize the breadth of ethnic communities represented in American society. But he has always involved himself in Hispanic-American affairs, and hopes his trip into space will help draw attention to the technological plight of Latin America.

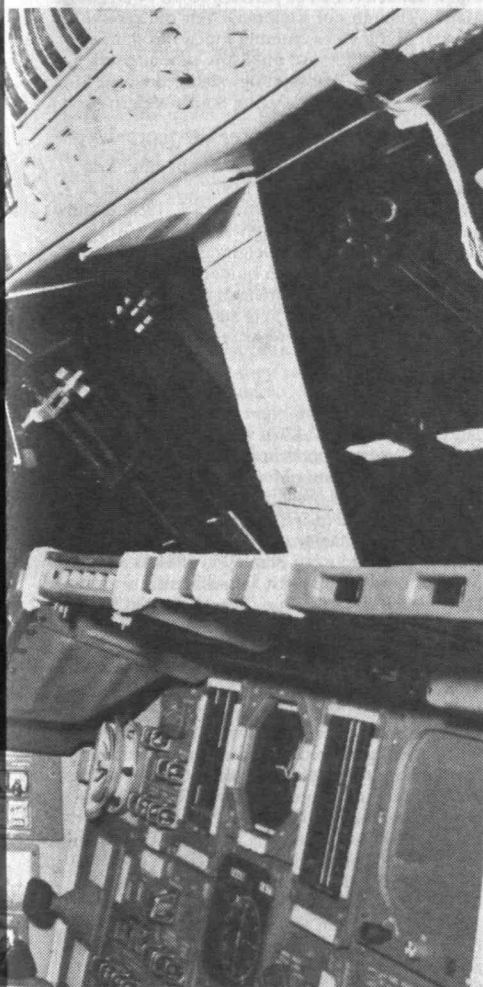


"Perhaps then," he told Peggy Hernandez of the *Boston Globe*, "we'll be able to enhance the ability to transfer technology from the advanced industrial nations to other nations and allow them to develop very quickly."

It is this theme Chang-Diaz raises in speeches throughout the United States, Mexico, and Latin America. "He wants developed nations to guarantee Third World countries some of the 180 slots available in space for telecommunications satellites," wrote Ms. Hernandez. "He believes satellites can serve to solve

a host of world problems from illiteracy to hunger."

When he became an astronaut, Chang-Diaz left his job at the Charles Stark Draper Laboratory. He now spends a few days a month as a visiting scientist at the M.I.T. Plasma Fusion Center, where he's working in a group headed by Research Scientist Tien-Fang Yang on a plasma rocket concept. The idea is to propel a rocket by a hybrid system involving both plasma and ordinary gas that would use fuel far more sparingly than present rocket engines.



Among other duties on the *Columbia* flight, Chang-Diaz was in charge of *Columbia*'s materials science experiments—including one from the M.I.T. Materials Processing Center. Its goal: to determine the effect of a gravity-free environment on the rapid solidification that occurs when a molten metal is suddenly chilled. Such metals are known to have ultra-fine structures, say Professor Merton C. Flemings, '51, and Research Associate Yuh Shiohara, and several engineering applications await their commercialization. □

A childhood dream was fulfilled for Franklin Chang-Diaz, Sc.D.'77, when he flew as scientist-astronaut on space shuttle Columbia's first 1986 flight. After entering the Astronaut Corps in 1980, Chang-Diaz was photographed in the Johnson Space Center's shuttle mock-up (left), being fitted for his space suit (top), and during water survival training at Homestead Air Force Base, Florida.

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of the Boston Natural Areas Fund, Inc. (BNAF). Its purpose is to support the physical care of the arboretum land and plantings, thereby freeing the arboretum's academic income for teaching and research. The BNAF notes that the 100-year-old Arnold Arboretum is the only facility in the world that is both a public park and an area for scientific botanical research.

A case study used in several M.I.T. classes has now been published as a working paper by the M.I.T. Center for Real Estate Development: *Horton Plaza, San Diego: A Case Study of Public-Private Development*. Interest in the project stems from its unconventional design, innovative public-private relations, and varied occupancy—restaurants, night club, theater, hotel, farmers' market, art museum . . . Price: \$15; an accompanying exhibits volume is \$12.50; write to Room W31-310, M.I.T.

When Professor **Tunney F. Lee** returns to M.I.T. from a leave of absence as deputy commissioner of the Massachusetts Division of Capital Planning and Operations next September 1, he will be head of the department, succeeding Professor **Gary A. Hack**, Ph.D.'76. Lee joined the department in 1970 and is now professor of architecture and urban planning; he helped develop the Environmental Design Program, an interdepartmental curriculum leading to a dual professional degree in architecture and planning. His career focuses on citizen participation in planning decisions.

James McKellar, visiting professor at M.I.T., is now director of the Center for Real Estate Development at M.I.T., and **Jerold S. Kayden**, formerly a fellow at Lincoln Institute of Land Policy, is associate director for education and director of the master's program in real estate development. **Charles H. Spaulding**, '51, who founded the center and was its first director, is now chairman. The changes, says Spaulding, are planned "to strengthen the center's academic and research activities" and to prepare for a fund-raising campaign to secure endowment funding.

Fernando Cruz-Villalba, reports on recent activities: research studies on house construction technology in Caribbean and South American cities; economic analysis of financial investment programs (for international donor agencies); and a private consulting practice . . . clients include AID, National Association of Home Builders, World Bank, Inter-American Foundation, and Ministries of Housing and Finance of Central America. . . . **Michael Furlong**, M.C.P.'79, of Darlinghurst, Australia, passed away on December 5, 1985; no further details are available.

XIII OCEAN ENGINEERING

Alfred A. H. Keil, who was head of the department before becoming dean of M.I.T.'s School of Engineering, has been honored by the naming of graduate fellowships in his honor. Keil Fellowships for the Wiser Uses of Science and Technology will be awarded beginning this September; students in all departments of the School of Engineering are eligible to apply.

Mitchell Steller, S.M.'73, a specialist in shipbuilding and marine engineering, has been elected a principal of Temple, Barker and Sloane, Inc. (TBS), Lexington, Mass. Steller joined TBS in 1981 after holding management positions with General Dynamics and Exxon. . . . **Alf L. Carroll**, S.M.'83, has been named mechanical design engineer for EMATT, an expendable training target project at Sippican Ocean Systems, Inc., Marion, Mass., a designer and manufacturer of oceanographic instruments and defense systems.

Rear Admiral **Richard M. Watt**, Jr., S.M.'23, U.S.N. (retired), died in Fryeburg, Maine, on December 19, 1985. Watt was a specialist in the design and construction of surface ships. He served at many major shipbuilding and navy yards and at the end of World War II, he was awarded the Legion of Merit for his role in the production of destroyer escorts and landing craft. Following the war, Watt served as commander of the Boston

Computer Suitor

Guy Barudin, completing his first year as a master's student in the Sloan School of Management, married Julie Lewin on May 18.

Nothing so unusual about that, but read on.

While doing a survey of campus computer users, the *New York Times* came across Barudin's case as an example of how the machines are "reshaping social life on American campuses."

Barudin used electronic mail—messages sent via computer—to get to know Lewin, a fellow engineering student at Princeton with whom he had a nod-in-passing acquaintance.

"Every few days I'd write her a little note," said Barudin, "and when I'd log on there'd usually be a note for me. It was just chitchat. Because we were in different years, with no classes in common, computer mail let us talk and get to know each other. She's shy, and this definitely helped her."

Lewin agreed: "We had never really talked to each other before. We started writing letters, and then flirting in the letters. I don't think we could have done that in person. The computer bridged the gap."

But, Barudin was asked, what about the time-honored tradition in which the young woman being courted saves her love letters, wrapping them in a pink ribbon?

"Well, it is a little impersonal on the computer in that respect," Barudin admitted, "But actually she did print some of them out." □

Naval Shipyard, assistant chief of naval material and director of the Industrial Survey Division in the Office of the Chief of Naval Operations. Watt retired from the military in 1956, thereafter serving as an advisor with the Kaiser Corp. and the Grumman Aircraft Corp. . . . Rear Admiral (USN) **John T. Wulff**, S.M.'41, passed away on May 1, 1985; no further details are available.

XIV ECONOMICS

Assistant Professor **Julio Rotemberg** of the department at M.I.T. has received a \$25,000 fellowship from the Alfred P. Sloan Foundation. As a young scientist of "extraordinary promise," Rotemberg is free to use the funds for research that is of most interest to him.

Robert A. Feldman, Ph.D.'84, of Arlington, Va., is working at the German desk at the International Monetary Fund. . . . **A. Mitchell Polinsky**, Ph.D.'73, has been appointed to the Josephine Scott Crocker Professorship in law and economics at Stanford Law School, cited as a "prolific scholar, a gifted teacher, and an infectious advocate of the relevance of economics to various legal problems." Polinsky, a member of the Stanford faculty since 1979, is the author of *An Introduction to Law and Economics* (1983).

XV MANAGEMENT

John M. Hennessy, '70, is chairman, president and chief executive officer of Credit Suisse First Boston Ltd., London. Hennessy was formerly managing director of First Boston Corp., New York City. . . . **Thomas Q. Lebrun**, S.M.'59, has resigned as vice-chairman and director of BanTec, Inc., Dallas, but will remain as a consultant to the firm. . . . **Leonard M. Lodish**, Ph.D.'68, chairman of the Marketing Department of the Wharton School of the University of Pennsylvania, has been elected director of Information Resources, Inc., Chicago. . . . **David Weir**, S.M.'73, associate director of admissions at Franklin Pierce College, Rindge, N.H., and a longtime environmentalist with special interest in land planning, was a candidate for selectman of Peterborough, N.H., last March. Though not a winner, Weir did receive 40 percent of the votes, gaining much recognition. Weir is also editor and publisher of a quarterly publication, *Monadnock*, a newsletter devoted to land planning issues, serving Southwestern New Hampshire.

Sheryl L. Hill-Tanquist, S.M.'79, writes, "My husband, Marshall, and I had a baby boy, Eric Marshall, born on July 10, 1985." . . . **David S. Grant**, S.M.'80, writes, "On April 1, 1985, Joanna and I had our second daughter—Stirling Ann Grant—another big girl weighing 10 pounds and nine ounces. We are both quite busy. I am travelling for work [Australia (twice), and India (once)]; building a cottage; and Jo is starting a business in high-quality children's wear (very timely!)."

Sloan Fellows

James I. Spiegel, S.M.'64, resigned early this year as president, consumer industrial products group of Wickes Cos., Santa Monica, Calif., formerly a subsidiary of Gulf Western Industries. . . . **Richard A. Derbes**, S.M.'71, has been named a principal at Morgan Stanley and Co., New York City. Derbes joined Morgan Stanley in 1984 as a vice-president in the Research Department. . . . **John D. Rudolph**, S.M.'73, has been promoted from manager of technical planning and analysis to director of technical planning and marketing at Corning Glass Works, Corning, N.Y.

Christopher B. Roberts, S.M.'85, director of Venture Financing for the Center for Space Policy, Cambridge, Md., and chief financial officer for Spacehab, has received the Space Foundation's National Excellence Recognition Award for "outstanding graduate research." Roberts' winning master's thesis was on "Financing Commercial Ventures in Space." . . . **William C. Salmon**, S.M.'57, has been appointed executive officer to the National Academy of Engineering, responsible for "coordinating the program activities of the Academy." Salmon was previously with the U.S. Department of State as senior advisor for science and technology to the under secretary for security assistance, science, and technology, and earlier he held engineering assignments at M.I.T. and Dynatech Corp. . . . **Robert H. Writz, Jr.**, S.M.'82, has changed jobs: from vice-president, marketing and business planning to manager, southern region at Sun Exploration and Production Co., a unit of Sun Company, Inc., Radnor, Penn.

Management of Technology Program

It is with great sorrow that the Management of Technology Program must report the death of **George M. Hess**, program participant in the 1986 class. George died of cancer on April 4. He was sponsored in the program by Boeing Aerospace Co. George was a very special person. His presence in class was always a wise, quick-witted, and driving one. Outside of class he was warm, intellectual, quiet-spoken, and sophisticated in a gentle, understated way. His extreme courage and that of his wife Jane during their months at

M.I.T. cannot be adequately described. He is sorely missed by his fellow program participants and the program faculty and staff.

Geoff Andrews, S.M.'82, sent Jane Morse a nice note in March. He says their new son, Jonathan, is growing fast and that Lindsay is delighted with her little brother. Geoff also reported that a second daughter was born to Susan and **Dave Rimmer**, S.M.'85, on March 4. . . . **John Harrison**, S.M.'83, writes, "I've been very busy on a new project—as project manager for the conceptual design of the facilities to support the next generation of Tokamak Fusion Reactor at Princeton Plasma Fusion Lab." He says he saw Mel Horwich in Washington, D.C., this spring at the First International Conference on Macro-engineering, an excellent conference, he reports. The Harrisons were not sure they could make it to the MOT Reunion this June, but they would love to see everyone again!

John Kindinger, S.M.'85, writes he and his family are finally settled in Orange County, Calif., and the home office of Pickard, Lowe and Garrick, Inc. He's enjoying his job but hopes some of the travel will slow down a bit now. He says they missed the Orrs (**Rick Orr**, S.M.'85), who moved to Arlington, Tex., just before John and his family arrived! Cindy and Jenny are adjusting well to their new home in El Toro. . . . **Rosalind**, the wife of **John Krawiec**, S.M.'85, called Jacalyn Walker-Sharp in April to let her know they'd be coming to the reunion in June. She reported they'd just had snow in Utah!

Ken Miller, S.M.'82, stopped by the Program Office in April. He was in Boston on business and was visiting with **John Wacholtz**, '73, current program student, as they were classmates at M.I.T. as undergraduates. Ken hoped he and Joan can come to the reunion dinner. . . . **Hank Montrey**, S.M.'82, was at M.I.T. on April 9 to give his annual lecture in the class given by **Jim Utterback**, Ph.D.'69. He reported enjoying his new position with the U.S. Forest Products Lab (Hank is deputy director) but says he's on the road a great deal. The Montreys' house in Tacoma has finally sold, so Lynn and the family moved to Madison in April. . . . **Richard Norton**, S.M.'85, called the Program Office in March. He likes his current position with F.X.M. Enterprises and is "keeping occupied" being responsible for \$10 million in construction. He and Karen are in the process of adopting their second child.—Jane Morse, Program Manager, M.I.T., Room E52-125, Cambridge, MA 02139

XVI AERONAUTICS AND ASTRONAUTICS

The name of **Arthur G. B. Metcalf**, '32, has been given by Boston University to its new \$100 million Science and Engineering Center. Metcalf was the first professor of engineering at Boston University when he joined the faculty there in 1935; he founded a Department of Aeronautical Engineering in B.U.'s College of Business Administration, which later became the College of Engineering. Metcalf is chairman of the Board of Electronics Corp. of America, which he founded in the 1930s; he's also chairman of the Boston University Board of Trustees.

Martin C. Jischke, Ph.D.'68, has been recently appointed chancellor of the University of Missouri, Rolla. Jischke has been dean of the University of Oklahoma's College of Engineering since 1981 and served as interim president for eight months in 1985. . . . **John M. Vergoz**, S.M.'63, has been appointed vice-president of technology for the Budd Co., Troy, Mich., an automotive supplier. Vergoz is responsible for "the future direction of the technical activities of Budd"; formerly he held several executive posts with North American Rockwell, Kelsey-Hayes, and ITT.

William A. Sangster, S.M.'37, reports that he is retired and lives at 2796 Arbutus Rd., Victoria, B.C., Canada V8N-5X3. . . . Vice Admiral **Clarence E. Ekstrom**, S.M.'31, (U.S.N. retired) of Coronado, Calif., passed away on January 10, 1986.



A. A. Young

XVII POLITICAL SCIENCE

Lerner Thesis Awards, named in honor of the late Professor **Daniel Lerner** of M.I.T., have been announced by the department: cowinners of the 1985 Doctoral Thesis Award are **Norma Jean Kriger**, Ph.D.'85, for "Rural Conflicts in Zimbabwe's War of Liberation" and **Maria de Castro Santos**, Ph.D.'85, for "Alcohol as a Fuel in Brazil." The Master's Thesis Award went to **Lisa Allen Vawter**, S.M.'85, for "The Case of Telecommunications in the U.S. Technology Transfer to China."

St. Martin's Press, New York, is the publisher of the fourth edition of *Technology and the Future* by **Albert H. Teich**, '64 (1986, \$13.95). The book, says its author, "reflects my own search for purpose in the development of technological society." The fourth edition contains a new section, "Using Technology," in which contributors discuss the use of advanced technology to promote economic growth and national security. Teich is head of the Office of Public Sector Programs at the American Association for the Advancement of Science.

Professor **Lincoln P. Bloomfield**'s *CASCON* system (Computer-Aided System for Information on Local Conflicts) is now available for personal computers. *CASCON* contains data on more than 60 "small wars" since 1945, and it can compare the important factors leading to each with any conflict—real or imagined—that its users might offer.

Alma H. Young, Ph.D.'78, associate professor and associate director of the University of New Orleans School of Urban and Regional Studies (SURS), has been appointed vice-chancellor for academic affairs at the university. Young was also elected vice-president/president elect of the Caribbean Studies Association. Young joined the staff of SURS in 1976 as a specialist in urban political economy and social planning and policy. Among Young's earlier activities: special assistant to the mayor of New Orleans (1978-1980); project consultant for *State of Black New Orleans*, a 1985 publication of the Urban League of Greater New Orleans; and the 1984 Task Force on the Future of the City.

XVIII MATHEMATICS

Professor **Victor Kac** of M.I.T. has been honored with a Guggenheim Fellowship for 1986, to support his studies in representation theory. . . . A Kyoto Prize sponsored by the Inamori Foundation, awarded to those whose fields of accomplishments are not covered by the Nobel Prizes was given to **Claude E. Shannon**, Ph.D.'40, Donner Professor of Science Emeritus at M.I.T. Shannon's prize was the first given in basic sciences, citing "his achievements in developing a mathematically-based theory of information." . . . **Sandra Fillebrown**, '75, has completed her year as visiting assistant professor of mathematics at Lehigh University, Bethlehem, Penn.

Mark G. Tanenbaum, '65, mathematician in the Space and Ocean Geodesy Branch of the Naval Surface Weapons Center, received the Navy Meritorious Civilian Service Award at the Center's annual awards ceremony last December. Tanenbaum was recognized for "his technical skills in

ocean geodesy and his contribution to World Geodetic System 1984 (WGS-84) . . . making major contributions to geodetic systems within the navy and Department of Defense."

XX APPLIED BIOLOGICAL SCIENCES

Continuing the refocus implied by its new name, the department at M.I.T. has discontinued graduate enrollments for master's degrees in four areas: food science, nutritional biochemistry and metabolism, toxicology, and neural and endocrine regulation. The master's degree in biochemical engineering will be kept, and a new master's degree will be added in applied biological sciences.

XXII NUCLEAR ENGINEERING

Mark F. Samek, S.M.'75, is the instrumentation and controls engineering supervisor for Millstone 1 and 2 nuclear power plants for Northeast Utilities Services Co., Hartford, Conn. . . . **William T. McCormick, Jr.**, Ph.D.'69, has been elected chairman and chief executive officer of Consumers Power Co., Michigan's largest utility, with assets of \$8.8 billion.

Charles K. Anderson, '69, has been promoted to director of marketing and business development for nuclear fuel at the Power Systems Group of Combustion Engineering, Inc., Stamford, Conn. Anderson joined C-E in 1969 and since has held a variety of positions in the Nuclear Systems Division, most recently as manager of business development. . . . **Martin Becker**, Ph.D.'22, has been appointed associate dean of engineering for research at Rensselaer Polytechnic Institute, Troy, N.Y.

TECHNOLOGY AND POLICY PROGRAM

Tom Davidson, S.M.'79, owns his own company (Summit Wind Systems) and has been working in conjunction with another consulting firm doing energy management and building energy systems design. . . . **Renata Davidson**, S.M.'82, is now working for Xenergy, doing marketing programs for electrical energy.

Eric Paillas, S.M.'83, is working with GTM in Cherbourg, France, building an extension for the company's plant for the retreatment of nuclear wastes.—Richard de Neufville, Chairman, Technology and Policy Program, M.I.T., Room 1-138, Cambridge, MA 02139

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**Roy Lamson, 1908-1986:
Champion of Humanities and the Arts**

Professor Emeritus Roy Lamson, professor of literature and historian and a long-time champion of the arts and humanities at M.I.T., died on May 3 in Cambridge; he was 78.

President Emeritus Jerome B. Wiesner, who worked closely with Professor Lamson on the Council for the Arts, paid tribute to his "single-minded enthusiasm for enriching the humanities at M.I.T." Lamson's major drive, said President Wiesner, was "to give humanities a 20th-century context."

Professor Lamson came to the Institute as a visiting professor from Williams College in 1957, and he joined the faculty in the following year. Soon thereafter he conceived and became director of the programs in Humanities and Engineering and Humanities and Science—in which students studied in humanities and one field of science or engineering for undergraduate degrees. In 1971 he was appointed assistant to the president for arts, an assignment which he kept following retirement in 1973 from full-time teaching. Also beginning in 1971, Lamson held the Class of 1922 Professorship.

As special assistant to the president, Professor Lamson became a principal architect for the Council for the Arts, the organization that fosters, supports, and promotes the arts on campus. It was a role in which he served "with great distinction," said Wiesner, making the council a major factor in the Institute community as a sponsor and advocate of both student and professional artistic activities.

He also had a lively interest and talent in music: he was a founding member of the Intermission Trio (a jazz group in which he played clarinet), president of the Cambridge Society for Early Music, director of the Cambridge Symphony Orchestra, and a trustee of the New England Conservatory of Music.

Before coming to M.I.T., Lamson was for 18 years a faculty member at Williams College, where he had also served

as dean of freshmen. He studied English at Harvard and during World War II was an historian with the War Department. Professor Lamson had a special interest in international relations and military affairs throughout his career.

**Karl L. Wildes, 1896-1986:
Historian of Electrical Engineering**

Although most alumni will remember Karl L. Wildes, S.M.'22, for his work in network theory and for his advocacy of cooperative education, his was also known as the historian of Course VI, in which he taught for over 30 years. Professor Wildes died on April 30 at the age of 90.

Wildes came to the Institute before completing his undergraduate degree at the University of New Hampshire to become instructor in mathematics in 1920. Two years later he completed his master's degree in electrical engineering, and he continued to work toward a doctorate—meanwhile joining the electrical engineering faculty in 1928.

Wildes' professional contributions were in the application of mathematics and physics to network theory, especially in the transmission and distribution of electrical power.

He retired in 1961 and tackled full-time what had previously been a spare-time activity: compiling the history of electrical engineering at M.I.T. The result was *A Century of Electrical Engineering and Computer Science at M.I.T., 1882-1982*, for which Nilo A. Lindgren, '48, was co-author. Publication of the book was a feature of the department's centennial, and it has been described as a chronicle of the roots of high-technology in Massachusetts.

Secor D. Browne, 1917-1986

After an unusual dual career in language studies and air transportation, Secor D. Browne died on March 23 in Boston. He was 69.

Browne was a member of the M.I.T. faculty from 1962 until 1969. He held faculty posts in the Departments of

Modern Languages, where he taught Russian, and the Department of Aeronautics and Astronautics, where he taught a graduate seminar in flight transportation.

Professor Brown left M.I.T. to accept appointments by President Nixon as assistant secretary for research and technology in the Department of Transportation and later as chairman of the Civil Aeronautics Board. Since 1973, when he left the government, Browne had been a widely-sought consultant on air transportation.

Lloyd D. Brace, 1903-1986

Lloyd D. Brace, former president and chairman of the First National Bank of Boston (now the Bank of Boston) and life member emeritus of the M.I.T. Corporation, died in Boston on April 20 after a long illness; he was 83.

Mr. Brace was elected to the Corporation in 1953, just in time to be a valued counselor during 20 years of unprecedented growth and change. He retired to be life member emeritus in 1974 after making "significant contributions to the work of the Institute through service on Corporation committees as well as astute financial counsel," according to the tribute by David S. Saxon, '41, chairman of the Corporation. Mr. Brace was a director of a number of major corporations and a trustee of several public institutions including his alma mater, Dartmouth College.

Clarence L. A. Wynd, 1901-1986

Clarence L. A. Wynd, S.M.'27, retired vice-president of Eastman Kodak Co. who served as the 67th president of the M.I.T. Alumni Association in 1960-61, died at his home in Pittsford, N.Y., on March 20 at the age of 85. He had suffered a massive stroke early this year.

Mr. Wynd was a member of the Corporation from 1957 to 1962. He had a 40-year career with Eastman Kodak, joining the company upon completing his degree in chemical engineering.

Deceased

The following deaths have been reported to the Alumni Association since the *Review's* last deadline: **Norman E. Seavey**, '99; February 1, 1986; Orlando, Fla.

Harold O. Stewart, '09; February 15, 1986; Rochester, N.Y.

John B. Babcock III, '10; February 19, 1986; Portland, Maine.

Karl W. Gasche, '10; March 13, 1986; Reading, Penn.

Mrs. R. Howard Annin, '14; July 30, 1979; Pasadena, Calif.

George J. Easter, '15; December 25, 1985; Buffalo, N.Y.

Carl A. Fuess, '17; March 8, 1986; Dallas, Tex.

Mrs. Walter F. Pond, '17; 1986; Glastonbury, Conn.

Douglas R. Buchanan, '18; February 3, 1986; Kingstree, S.C.

Walter H. Robertson, '18; January 21, 1986; Canton, Ohio.

Walter C. Roberts, '19; December 3, 1985; Weymouth, Mass.

Myles S. Perkins, '20; December 24, 1985; San Diego, Calif.

Laurence E. Weymouth, '20; February 1986; Clearwater, Fla.

Laurence K. Burrell, '21; March 8, 1986; East Bridge-water, Mass.

Herbert W. Gwynn, '21; December 29, 1985; Naples, Fla.

Donald F. Lyman, '21; February 9, 1986; St. Petersburg, Fla.

Rudolf H. Blatter, '22; April 8, 1986; Sarasota, Fla.

Alexander L.M. Dingee, '22; April 28, 1986; Waver-town, Mass.

Lachlan Mackenzie, '22; November 30, 1985; Santa Barbara, Calif.

Fearing Pratt, '22; February 27, 1986; Hingham, Mass.

William J. Schaefer, '22; February 13, 1986; Winter Park, Fla.

William Schulman, '22; March 9, 1986; Baltimore, Md.

Henry Ross Wiggs, '22; March 16, 1986; Hamilton, Ontario, Canada.

Karl L. Wildes, '22; April 30, 1986; Bedford, Mass.

Harvey L. Williams, '22; March 23, 1986; Delray Beach, Fla.

Charles T. Jackson, '23; November 20, 1985; Hew-lett, N.Y.

Stewart E. Reimel, '23; July 24, 1985; Fairfax, Va.

Harry L. Thompson, '23; February 12, 1986; Polson, Mont.

Willard C. Blaisdell, '24; July 12, 1985; Elizabeth, N.J.

Martin J. Buerger, '24; February 25, 1986; Lincoln Center, Mass.

George J. Harrington, '24; February 25, 1986; Swampscott, Mass.

Mrs. Helen G. Welling, '24; September 25, 1985; Syracuse, N.Y.

William T. Brown, Jr., '25; February 2, 1986; Bruns-wick, Me.

Hector Harrison, '25; December 27, 1985; Oakland, Calif.

James H. Howard, '25; April 15, 1986; Cambridge, Mass.

Ralph E. Lehan, '25; January 22, 1986; Warwick, R.I.

George E. Mason, '25; May 12, 1985; Baldwinville, Mass.

Casper Ranger II, '25; January 20, 1986; East Or-leans, Mass.

Charles C. Rickerson, '26; April 18, 1984; Mars, Penn.

George W. Brady, '27; February 10, 1986; Washing-ton, D.C.

Percy L. Richardson, '27; February 3, 1986; Ann Arbor, Mich.

Winfred A. Witham, '27; August 13, 1985; Cayucos, Calif.

Clarence L.A. Wynd, '27; March 20, 1986; Roches-ter, N.Y.

Irl R. Clarke, '28; January 15, 1986; Austell, Ga.

William R. Grunwell, '28; April 1, 1986; Engle-wood, Fla.

William L. Hilliard, '29; April 7, 1986; La Jolla, Calif.

Roger A. Sykes, '29; February 16, 1986; Largo, Fla.

Ray C. Williams, '29; December 24, 1985; Calumet City, Ill.

Rene Laplante, '30; December 23, 1984; Outremont, Canada.

David W. Bernstein, '31; April 17, 1986; Boston.

Mrs. Harold H. Carr, '31; 1986; Methow, Wash.

Carleton B. Dix, '31; December 14, 1985; Ashland, Mass.

Clarence E. Ekstrom, '31; January 10, 1986; Coronado, Calif.

John N. Fricker, '31; March 8, 1986; Charlotte Har-bor, Fla.

Arthur E. Jorjorian, '31; April 4, 1986; Worcester, Mass.

Harry Landsman, '31; January 24, 1986; Miami Beach, Fla.

Joseph P. McBrien, '31; December 18, 1985; Mar-tinez, Calif.

Philip T. Boothby, '32; March 17, 1986; North Con-way, N.H.

Timothy P. Coffey, '32; November 28, 1985; Cam-bridge, Mass.

James M. McMartin, '32; March 24, 1986; Sarasota, Fla.

George H. Isserlis, '33; March 14, 1986; New York, N.Y.

Carroll D. Fentress, '34; November 13, 1985; Eu-gene, Ore.

Julius Goldberg, '34; March 3, 1986; New Bedford, Mass.

George M. Siegel, '34; February 9, 1986; Longmea-dow, Mass.

Robert W. Forster, '35; March 30, 1986; Wellesley, Mass.

Benjamin M. Gruzen, '35; March 1986; Campbell, Calif.

Samuel J. Whitmore, Jr., '35; November 26, 1985; Santa Monica, Calif.

E. Arthur Boyan, '36; December 8, 1985; Riverside, Calif.

Robert M. Haynes, '36; February 18, 1985; Floral City, Fla.

Roger H. Huston, '36; January 27, 1986; Escondido, Calif.

Laxton M. Smith, '36; December 15, 1985; Venice, Fla.

Philip S. Vincent, '36; January 11, 1986; Lansdale, Penn.

Albert C. Faatz, Jr., '37; January 8, 1984; Montclair, N.J.

William G. Gibson, '38; March 27, 1985; Alexan-dria, Va.

Richard H. Howe, '38; February 25, 1986; Danvers, Mass.

Robert S. Cady, '39; February 17, 1986; Watertown, Conn.

Charles Friedman, '39; November 1985; Freeport, N.Y.

John R. Wuehrman, '40; February 24, 1986; Te-questa, Fla.

Edmund F. Dandrow, '41; September 15, 1985; Fair-fax, Va.

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Arnold S. Mengel, '41; November 21, 1985; Vista, Calif.

Francis B. Merkle, '41; March 8, 1986; Bethesda, Md.

Walter L. Threadgill, '41; March 17, 1986; Baton Rouge, La.

John T. Wulff, '41; May 1, 1985.

William J. Knapp, '42; January 15, 1986; Los An-geles, Calif.

Eliot W. Reynolds, '42; April 15, 1986; Southfield, Mich.

John G. McMullin, '43; April 9, 1986; Newport Beach, Calif.

Irvin T. Olsen, '43; February 15, 1986; Henderson-ville, N.C.

Hugh G. Pastoriza, Jr., '43; April 26, 1986; Bronx-ville, N.Y.

Palmer P. Derby, '44; June 23, 1985; Weston, Mass.

Robert B. Schick, '44; March 6, 1986; Salt Lake City, Utah.

Albert J. Seymour, '44; May 3, 1982.

Sanford J. Neuhaus, '45; March 24, 1986.

Hasmukh P. Oza, '46; August 4, 1985; Ahmedabad, India.

Ralph H. Baker, Jr., '47; July 7, 1985; Neptune Beach, Fla.

George Richard Turner, '47; April 11, 1986; El-mira, N.Y.

Robert P. Whorf, '47; 1986; Atkinson, N.H.

William B.S. Leong, '48; March 17, 1986.

John W. Murray, '48; January 13, 1986; Pocasset, Mass.

Arthur J. Renz, '48; February 23, 1986; Hanover, N.H.

Richard Scott, '48; November 16, 1985; Midland, Canada.

Calvin Wong, '48; June 3, 1985; Livermore, Calif.

Cornelius F. Day, '49; January 26, 1986; Arlington, Va.

Clyde L. Olson, '50; December 4, 1985; Alexandria, Va.

Charles P. Wurth, '50; 1985; Sandweiler, Luxem-bourg.

William A. Wintz, Jr., '51; 1985; Baton Rouge, La.

John C. Mott-Smith, '52; June 15, 1985; Lexington, Mass.

Norman R. Gardner, '53; January 9, 1986; Boston, Mass.

David H. Everest, '54; July 14, 1985; Coral Springs, Fla.

Loren D. Grubb, '54; February 5, 1986; Sulphur, La.

Jean Y. Caron, '55; January 1986; Quebec, Canada.

Norman L. Peterson, '57; April 17, 1986; Urbana, Ill.

Roy H. Anderson, '58; January 4, 1986; Roselle, N.J.

Ebert E. Fournace, '60; October 21, 1985; Canton, Ohio.

C. William Lord, '63; March 18, 1986; Los Angeles, Calif.

James K. Hartman, '65; March 25, 1986; Salinas, Calif.

Douglas R. Arnoldi, '67; October 25, 1985; South-bury, Conn.

Jerald R. Lenz, '69; December 12, 1985; Waukesha, Wisc.

Abraham C. Setnick, '69; June 20, 1985; Dallas, Tex.

Terry V. Sprenkel, '73; December 20, 1984; South Windsor, Conn.

Jonathan T. Frueh, '78; March 7, 1986; Storrs, Conn.

Eric A. Umland, '78; November 17, 1985; Altadena, Calif.

Michael Furlong, '79; December 5, 1985; Darling-hurst, Australia.

Barbara D. Rosemark, '79; December 1983; Sher-mans Oaks, Calif.

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PUZZLE CORNER ALLAN J. GOTTLIEB

Back to Kresge Without Road-Runner

Last week I went to a VLSI conference in Kresge Auditorium at M.I.T. where, as an undergraduate many years ago, I used to watch movies on weekends. I remember those days well. In particular, I have many fond memories of active audience participation during the Road Runner cartoons that often accompanied the featured movie. I was invited to the conference to speak about results obtained by our ultracomputer research project here at NYU, but it was *very* hard for me to stand on the Kresge stage and look out at the audience; the Road Runner memories were so strong. Indeed, whenever I projected a new overhead transparency, I felt as though a sharp "beep beep" was in order.

FLASH! Phil Hugin just called to say that he and a consultant from Cornell University have decided on a winner of the \$100 JAN 2 sweepstakes. Mr. Hugin reports that nearly all the responders found the parametric solution that he had also discovered but that no one obtained a closed-form solution. That is, errors were found in all the closed-form attempts. Apparently, the consultant had a hard time finding the error in one of these but eventually succeeded. The winning entry supplied a converging series whose error can be made $O(r^k)$ for arbitrary k by including enough terms of the series. The solution will appear next issue. The envelope, please. The winner is . . . (fumble, fumble, rip) . . . David Meyer!

Problems

JUL 1. We begin with a bridge problem from Winslow Hartford. The hand was played by 80-year-old Elmer Schwartz of Cleveland and reported by the *Cleveland Plain Dealer* for November 18, 1984: The

contract is six hearts by South, East having bid spades; and the ♠7 is led.

♠ A J 9 8	♠ K Q 10 4 3
♥ Q 9	♥ 8 7 6
♦ Q 5 4 2	♦ A 3
♣ 4 3 2	♣ Q 10 8
♠ 7 6 5	♠ 2
♥ 3 2	♥ A K J 10 5 4
♦ J 10 9 6	♦ K 8 7
♣ J 9 6 5	♣ A K 7

JUL 2. Phelps Meaker needs help with his sloping lampshade. A six-sided lampshade assembled from parchment trapezoids is larger at the bottom than at the top. The two parallel sides and the height of the trapezoids are in the ratio 2:3:4. How much does a side slope from the vertical?

JUL 3. Jerry Grossman would like you to find a pattern or better yet a closed form for $f(n)$ defined by:

$$f(1) = 1$$

$$f(n) = f[n - f(n - 1)] + 1 \text{ for } n > 1$$

JUL 4. Smith D. Turner (f.d.t) asks about the spy letter that came in out of the rain:

A spy received a rain-soaked letter. The stamp was gone, and all the postmark was obliterated except two contiguous letters, "ON." The contents bore no letterhead, but on decoding the letter the spy concluded it must have been mailed in Bonn, London, or Washington. What is the probability it was mailed in London?

JUL 5. Allen Wiegner wants us to analyze his M&M consumption algorithm:

I love M&M's, but have an odd way of eating them. I remove one at a time at random from the bag and place it on the table. Whenever there are two of the same color on the table, I eat those two. After I have removed 100 M&M's from the bag, how many might I expect to find left on the table? (Assume there are five colors altogether, distributed equally.) After 101? If brown ones are twice as common as the other colors, how do the expected values change after 100 and after 101?



SEND PROBLEMS, SOLUTIONS, AND COMMENTS TO
ALLAN J. GOTTLIEB, '67, THE
COURANT INSTITUTE, NEW
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10012.

Speed Department

SD 1. Back in the dark ages (1968, in fact) I was boasting to a friend about an electronic calculator (then an unheard-of novelty) on which I had computed .99¹⁰⁰ in 15 seconds. "Point nine nine to the one-hundredth?" my friend said. "That's easy. It's .37" How did he do it?

SD 2. Ron Raines recalls an advantage of the "old style" watches:

How can you tell which direction is north using only an analog watch and the position of the sun? How would the answer differ if you were in the Southern Hemisphere? Ignore daylight savings time.

Solutions

F/M 1. Construct a deal such that North-South can make seven no-trump against the worst defense with North-South having the minimum number of high-card points. By worst defense we mean that the declarer can specify which (legal) cards the defenders are to play at each trick.

Our first solution is from Robert Bart. North-South can make seven no-trump with zero points and no card higher than a nine.

♠ 5 4 3 2
 ♥ 8 7 6 5 4 3 2
 ♦ —
 ♣ 3 2
 ♠ —
 ♥ J 10 9
 ♦ A K
 ♣ A K Q J 10 8 6 4
 ♠ —
 ♥ —
 ♦ Q J 10 9
 ♣ —
 ♠ 9 7
 ♥ —
 ♦ 9 8 7 6 5 4 3 2
 ♣ 9 7 5

West drops the ♠8 and ♠6 under South's ♠9 and ♠7 as East pitches the diamond honors. South then cashes the ♣9, ♣7, and ♣5. East under-playing with the ♣8, ♣6 and ♣4 while West throws his diamond honors. South takes the rest of the tricks with good diamonds.

Also solved by Allen Wiegner, Allen Zaklad, Matthew Fountain, Steve Feldman, Winslow Hartford, and the proposer, Howard Sard.

F/M 2. Find the age of Mrs. Grooby, Farmer Dunk's mother-in-law. The given facts: there are 20 shillings to the pound sterling, an acre is 4840 square yards, and a rood is a quarter of an acre. Do not assume the puzzle was invented this year. Also, these hints help: one number in the puzzle is the area of Dog's Mead in roods, but it relates to something in the puzzle quite different from that area. One of the numbers across is the same as one of the numbers down. All numbers are integers, and no number begins with an '0'. So here are the clues:

- Across**
- Area of Dog's Mead in square yards.
 - Age of Farmer Dunk's daughter, Martha.
 - The difference between the length and breadth of Dog's Mead in yards.
 - Number of roods in Dog's Mead times number nine down.
 - The year when Little Piggly came into occupation by Dunk family.
 - Farmer Dunk's age.
 - The year Farmer Dunk's youngest child, Mary, was born.
 - Perimeter of Dog's Mead in yards.
 - The cube of Farmer Dunk's walking speed in miles per hour.
 - Number fifteen across minus number nine down.

Down

- The value of Dog's Mead in shillings per acre.
- The square of Mrs. Grooby's age.
- The age of Mary.
- The value of Dog's Mead in pounds sterling.
- The age of Farmer Dunk's first-born, Edward, who will be twice as old as Mary next year.
- The square, in yards, of the breadth of Dog's Mead.
- The number of minutes Farmer Dunk needs to walk one and one third times around Dog's Mead.
- See number ten down.
- Ten across times nine down.
- One more than the sum of the digits in the second column down.
- Length of tenure, in years, of Little Piggly by the Dunk family.

The following solution is from Jim Rutledge:

1	3	8	7	2	0		4	1
5			5	3	2		6	4
5			9			7	3	5
		8	1	6	9	1	0	
10	7	2			11	1	9	12
	9					14	7	9
15	2	7			16	1	6	5

Assuming that this story puzzle takes place before or during the 20th century, 11A must begin with a 1 and 9D must perforce be 11 due to its use as a multiplier for 10A in which the leading digit is both a member of the multiplicand and the product. Since the last digit of 15A minus 9D is also the last digit of a squared term, 15A must be 27 (64 would produce a final 3—not the product of a square). 16A is 16 and, again assuming a pre-21st-century milieu, 8D must be 12. This fact yields the perimeter of Dog's Mead:

$$(4/3)P = 3 \text{ mph} \times (1/5) \text{ hr}$$

$$P = (9/20) \text{ mi} = 792 \text{ yds.}$$

Consequently, 14A is 792, and the length plus the breadth of Dog's Mead is 396 yards. According to 6A, 10 yds $\leq L - B \leq 99$ yds and the range of choices for L and B are 203/193 to 247/149. Of these, only the squares of the breadths 174 and 176, viz. 30276 and 30976, end in "76." The two possible areas are $222 \times 174 = 38628$ sq. yds. and $220 \times 176 = 38720$ sq. yds. Given that all numbers are integers and 1 acre = 4840 sq. yds., the actual area must be 38720 sq. yds., precisely 8 acres. Consequently, 1A is 38720, 6A is 44 and 7D is 30976. Also, the number of roods, 32, times 9D equals 7A, 352. This determines the age of Farmer Dunk's first-born Edward to be 45. His youngest daughter Mary then must be 22, 3D, and his daughter Martha must be either 22, 32, or 42. These figures yield a possible range for Mrs. Grooby's age of 85 to 86, where $85^2 = 7225$ and $86^2 = 7396$, and eliminate 42 as a choice for Martha. By simple addition, 12D is 19. Considering 11A, 8A, and 13D together, Mary could have been born in 1913 or 1914, Little Piggly could have arrived in 1610 or 1510, and 13D could have been 325 or 426, respectively. Since Martha's age could be 22 (as the second of twins) or 32, the hint concerning the area of Dog's Mead in roods was well-given. Therefore, Martha is 32, 5A; Mrs. Grooby is 86 and the square of her age is 7396, 2D; 8A is 1610, 11A is 1913, and 13D is 325. The value of Dog's Mead may be determined by simple calculation. Its worth in shillings per acre is between 300 and 399. At 20 shillings to the pound sterling, this translates

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into between 15 and 20 pounds per acre. Knowing that there are 8 acres, the total value of the land is between 120 and 160 pounds sterling. Therefore, 4D must be 142 pounds. This equals 2840 shillings and dividing by 8 yields 355 shillings per acre, 1D. Finally, Farmer Dunk's age remains in question since 62 and 72 are both viable possibilities. The hint, again well-given, that one of the numbers across is the same as one of the numbers down leads

to Farmer Dunk being 72 years old, 10A, so that 10D is 792, the same as 14A. And thereby is the puzzle of Dog's Mead unraveled.

Also solved by Dennis White, Allen Wiegner, Arthur Connick, Bill Hauke, Brian Mannion, Donald Berkey, Jim Landau, John Carlin, Matthew Fountain, Naomi Markovitz, Norman Spencer, Robert Bart, Runyon Colie, Steve Feldman, Victor Newton, and Winslow Hartford.

F/M 3. $N = (2K + 1)$ people own a bank. What is the minimum number of different locks that must be put on a safe so that when keys to these locks are distributed to the different people, every majority contains a complete set of keys, but no minority does?

Mike Harris found all the keys needed to solve this problem:

The group of $N = 2k + 1$ owners can be divided into a minority of k members and a majority of $k + 1$ members in M different ways, where

$$M = \frac{(2K + 1)!}{(K + 1)! K!} = \binom{2K + 1}{K}$$

To assure that each minority cannot open all the locks, and that each majority can open all the locks, do the following procedure in sequence for each of the M splits of the group: Attach a new lock to the safe and issue a key to each of the $k + 1$ majority of that split. Thus, the total number of locks is M , the total number of keys is $(k + 1)M$ and each owner is issued

$$n = [(k + 1)M]/(2k + 1) = (2k)!/(k!)^2$$

As an example, suppose Ann, Bob, and Carol own the bank. Three locks are attached to the safe and each owner has two keys. Labeling the locks 0, 1, and 2, key assignments are as shown:

Ann	0,1
Bob	1,2
Carol	2,0

If Dick and Ellen buy into the bank, $M = 10$ locks (numbered 0 through 9) must be used and $n = 6$ keys are issued to each owner as shown:

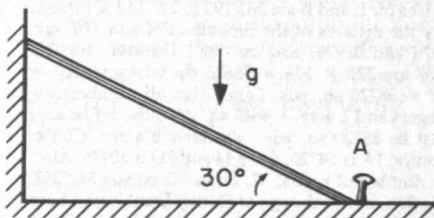
Ann	0,1,2,3,4,5
Bob	0,1,2,6,7,8
Carol	0,3,4,6,7,9
Dick	1,3,5,6,8,9
Ellen	2,4,5,7,8,9

If Frank and Ginger buy in, $M = 35$ locks must be used and $n = 20$ keys are issued to each owner.

Also solved by Allen Wiegner, Matthew Fountain, Naomi Markovitz, Robert Bart, Winslow Hartford, and the proposer, Joe Verducci.

F/M 4. A rigid, uniform stick one meter long is held leaning against a smooth vertical wall at a 30° angle to a smooth horizontal surface. When the stick is released, how fast will its center pass point A?

The following solution is from Matthew Fountain:



The stick passes the peg at 36.9 cm/sec. As neither wall nor floor move, they do not work on the stick. Its loss of potential energy during its fall is accompanied by an equal gain in kinetic energy. Letting Y be the height of the upper end of the stick, the center of gravity of the stick is at $Y/2$. The loss in potential energy when Y is less than its starting value of 50 cm. is $(100mg)(25 - Y/2)$. Here m is the weight/cm of the stick and g is equal to 980 cm/sec². During the fall of the stick, before the stick leaves contact with the wall, a point b cm from the lower end of the stick has a vertical velocity of $(b/100)(dY/dt)$ and a horizontal velocity of $[(100 - b)/100](dX/dt)$. Here X is the distance from the wall to the lower end of the stick. Kinetic energy equals $(1/2)(\text{mass})(\text{velocity})^2$. The kinetic energy during the early part of the fall is equal to

$$\int_0^{100} \{ (m/2)(b/100)^2 (dY/dt)^2 + [(100 - b)/100]^2 (dX/dt)^2 \} db$$

$$= (100m/6) [(dX/dt)^2 + (dY/dt)^2].$$

While the stick is in contact with the wall, $X^2 + Y^2 = 100^2$ and $2X(dX/dt) + 2Y(dY/dt) = 0$, making $(dY/dt)^2 = (X/Y)^2 (dX/dt)^2 = [(100^2 - Y^2)/Y^2] (dX/dt)^2$.

Substituting for $(dY/dt)^2$ and equating loss of potential energy to gain in kinetic energy,

$$100mg(25 - Y/2) = (100m/6) [1 + (100^2 - Y^2)/Y^2] (dX/dt)^2,$$

making $(dX/dt)^2 = 6g(25 - Y/2)Y^2/100^2 = 0.294(50Y^2 - Y^3)$. During the fall, as long as the stick is in contact with the wall, the center of the stick—the location of the center of gravity—accelerates horizontally in reaction to the force exerted by the wall. This acceleration decreases smoothly to zero at the moment the stick leaves contact with the wall. The lower end of the stick, which has been moving horizontally with twice the speed of the center of the stick, stops accelerating at the same time. The horizontal velocity of the center of the stick is constant after the stick leaves the wall. It equals $(1/2)dX/dt$ when $d^2X/dt^2 = 0$. Taking the derivative of $(dX/dt)^2 = 0.294(50Y^2 - Y^3)$, $2(dX/dt)(d^2X/dt^2) = 0.294(100Y - 3Y^2)(dY/dt)$, and $d^2X/dt^2 = 0$ at $Y = 100/3$.

At $Y = 100/3$, $dX/dt = \sqrt{0.294(50 - 100/3)(100/3)^2} = 73.8$. The stick moves past the peg at $73.8/2 = 36.9$ cm/sec.

Also solved by John Langhaar, Allen Wiegner, John Prussing, Winslow Hartford, and the proposer, Bruce Calder.

F/M 5. (1) Choose any four different digits. (2) Arrange them to make the largest number. (3) Arrange them to make the smallest number. (4) Subtract the smaller from the larger. (5) Take the result and go back to step 2 and see what happens.

Why does this procedure always converge to 7641? Is there a similar phenomenon for five-digit numbers, and if so why?

Winslow Hartford noticed that for five-digit numbers a fixed point does not always arise. For example, this is the situation when starting with 98632. Other numbers (eg. 86521) converge to 61974. To explain the phenomenon with four-digit numbers Matthew Fountain observes that when the procedure is followed, as illustrated by 7321 - 1237 = 6084, the outer digits of the result always sum to 10, the inner digits to 8, except when the inner digits are a pair of 9's. This restricts the results of the subtraction so that the numbers obtained are few in number. Checking all these cases shows that a number with the digits of 7641 always appears. As 7641 - 1467 = 6174, the procedure then stops.

Also solved by Reginald Bisson and the proposer, John Rudy.

Better Late Than Never

JAN 1. Peter Silverberg has responded.

JAN 2, 3, 4. John Langhaar has responded.

F/M SD1. Albert Mullin corrects an embarrassing typo: Ken Thompson received the ACM Turing award.

Proposers' Solutions to Speed Problems

SD 1. Anyone who solves this problem will be showing his age! The trick was to be familiar with the log-log scales on a slide rule. The scale, which runs from $e^{-0.1}$ to $e^{-0.001}$, starts somewhere around .99. Hence, .99 $\approx e^{-0.01}$ and .99¹⁰⁰ $\approx e^{-1}$, which to two-digit accuracy is .37.

SD 2. If you point the hour hand of the watch at the sun, north is midway between the hour hand and 12 o'clock. In the Southern Hemisphere, north is midway between the hour hand and 6 o'clock.

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*The participants didn't
want to miss out on a process
that their opponents
wanted in on.*

scenes caucusing became common throughout the negotiations, as the facilitator used shuttle diplomacy to get various groups to make trades.

The Nitty-Gritty

In the emergency-exemption demonstration, the definition of the word "emergency" was critical, since the resulting rule would concern emergency situations when certain pesticides could be used. The negotiators' give-and-take as they argued about the meaning of "emergency" reveals much about the nitty-gritty aspects of a negotiated rule-making.

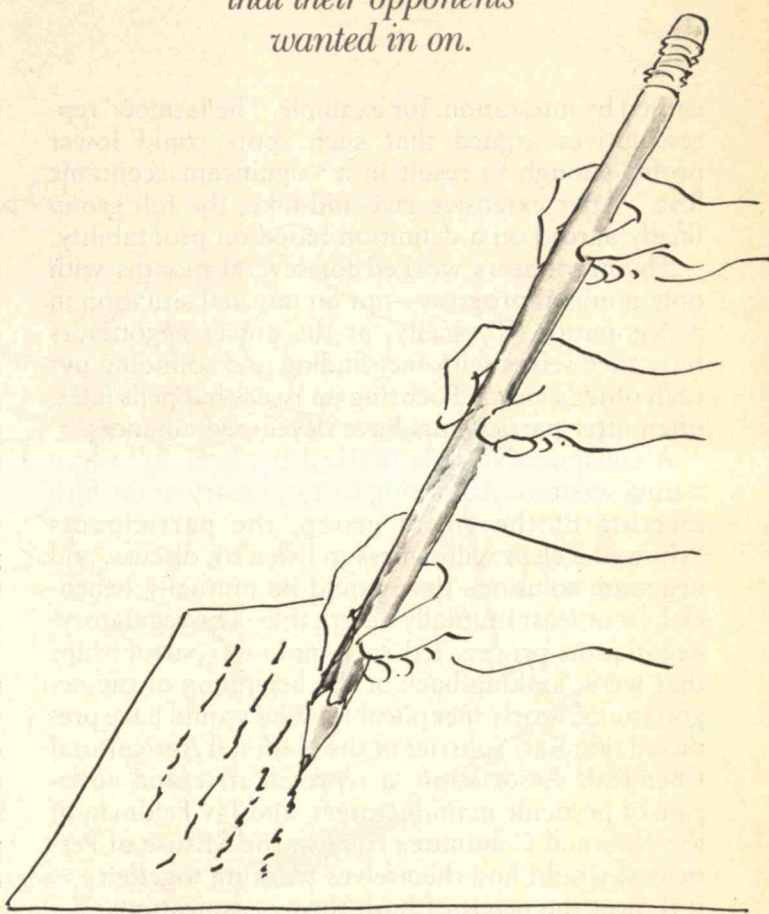
The problem in defining the word concerned how widespread a pest outbreak has to be to justify using pesticides that have not yet been fully tested for health effects. Can a single farm experience an emergency? Or does an entire region have to be damaged?

The negotiators set up a working group to answer these questions, and almost everyone in the negotiations—16 people—joined. The first time the group met, there were numerous false starts and disagreements. The representatives from the farmers' associations wanted individual farms to qualify for emergency exemptions, while the environmentalists thought exemptions should be available only when whole regions were affected. Some participants were noticeably unwilling to be persuaded by others' arguments. Nothing was settled, but the participants did hear each other's views.

Later, the working-group members agreed that the definition of "emergency" should hinge on the definition of "significant economic loss," since the extent of loss would determine how dire a situation was. But a subsequent meeting was inconclusive.

While it would appear that little progress was being made, the members of the group were actually working hard, acquiring a better understanding of each other's concerns. Peter Schneider, the ERM-McGlennon principal at the meetings, suspects that the participants were checking back with their organizations to see what they had to stay firm on and what opposing arguments they could accept.

Finally, the full negotiating team decided that five key participants should tackle the matter. That task force reached what appeared to be a breakthrough in its first session. At this meeting the two environmental representatives indicated that they would not accept any rule in which the phrase "significant economic loss" applied to a situation with less than a



regional impact. David Kronenberg, who monitored the sessions for the Public Disputes Program, believes the environmentalists thought that the regulations should allow only for those exemptions that would benefit a relatively broad sector of the public. After all, public health might be at risk if certain pesticides were used. Recognizing that the environmentalists would not waver, the rest of the group agreed to bring this proposal to the full negotiating team for discussion.

But that group concluded that the definition of the extent of an impact should be flexible. It reasoned that applications for exemptions should be considered on a case-by-case basis. So the language in the rule was left ambiguous.

The negotiators also had to decide whether a significant economic loss should be measured in terms of crop yield or profitability. Several environmentalists pushed to define economic loss in terms of decreased crop yield. They suggested that farmers should not worry about apples with harmless spots

caused by infestation, for example. The farmers' representatives argued that such spots could lower profits enough to result in a "significant economic loss." After extensive give-and-take, the full group finally agreed on a definition based on profitability.

The negotiators worked for several months with only minimal progress—not an unusual situation in a negotiation. Typically, at the outset negotiators busy themselves with fact finding and sounding out each other's views. Focusing on issues happens later, often after participants have developed alliances.

A collaborative style marked the later full negotiating sessions. According to a summary of the fifth meeting of the entire group, the participants "showed a clear willingness to listen to, discuss, and negotiate solutions that would be mutually beneficial, or at least mutually acceptable. The regulatory-negotiation process led to temporary partnerships that were, looking back at the beginning of the negotiations, nearly inexplicable. Who would have predicted that Earl Spurrier of the National Agricultural Chemicals Association, a representative and advocate of pesticide manufacturers, and Jay Feldman of the National Committee Against the Misuse of Pesticides, would find themselves working together . . . [to] meet the needs of both their organizations?"

By the end of the last scheduled meeting, the negotiators had drafted the entire rule, partly in working groups and partly en masse. This was quite different from the first EPA negotiated rule-making, when participants decided to reach consensus on the principles of the regulation rather than on the actual language of the rule. The emergency-exemption negotiators signed the proposed regulation, signifying that as individuals they would support it during the review and comment stage.

Three months later, on April 8, 1985, the proposed emergency-exemption rule was published in the *Federal Register*. In the meantime, the negotiators had explained the basis for the draft to their organizations, trying to ensure their support. Like anyone, members of these groups could have spoken against the draft rule during the several-month public review and comment stage. But none did.

The EPA received 16 comments from parties that had not been in the negotiations. The points were so minor, however, that none of the participants felt it was worthwhile to reconvene to discuss them. On January 15, 1986, the final rule was published. No lawsuits followed.

"Not the Ogres You Thought"

It was a noticeable mark of success that the rule passed the close scrutiny of people who had not been directly involved in the negotiations. But there were other measures of success, too.

Generally, the participants were pleased with the result. By the end of the process all but one group indicated that the negotiations had produced a rule more representative of their interests than the standard process probably would have, and with less conflict. The participants were inclined to feel good about the outcome, since they had had a hand in shaping it. The process had given them more control than the traditional method of developing rules.

Several participants said they had benefited from the chance to communicate directly with each other and iron out long-standing disagreements in person. About half the representatives for the agricultural industry said they had gained a clearer appreciation of the environmentalists' motives. One negotiator commented, "In working with the opposition you find they're not quite the ogres you thought they were, and they don't hate you as much as you thought."

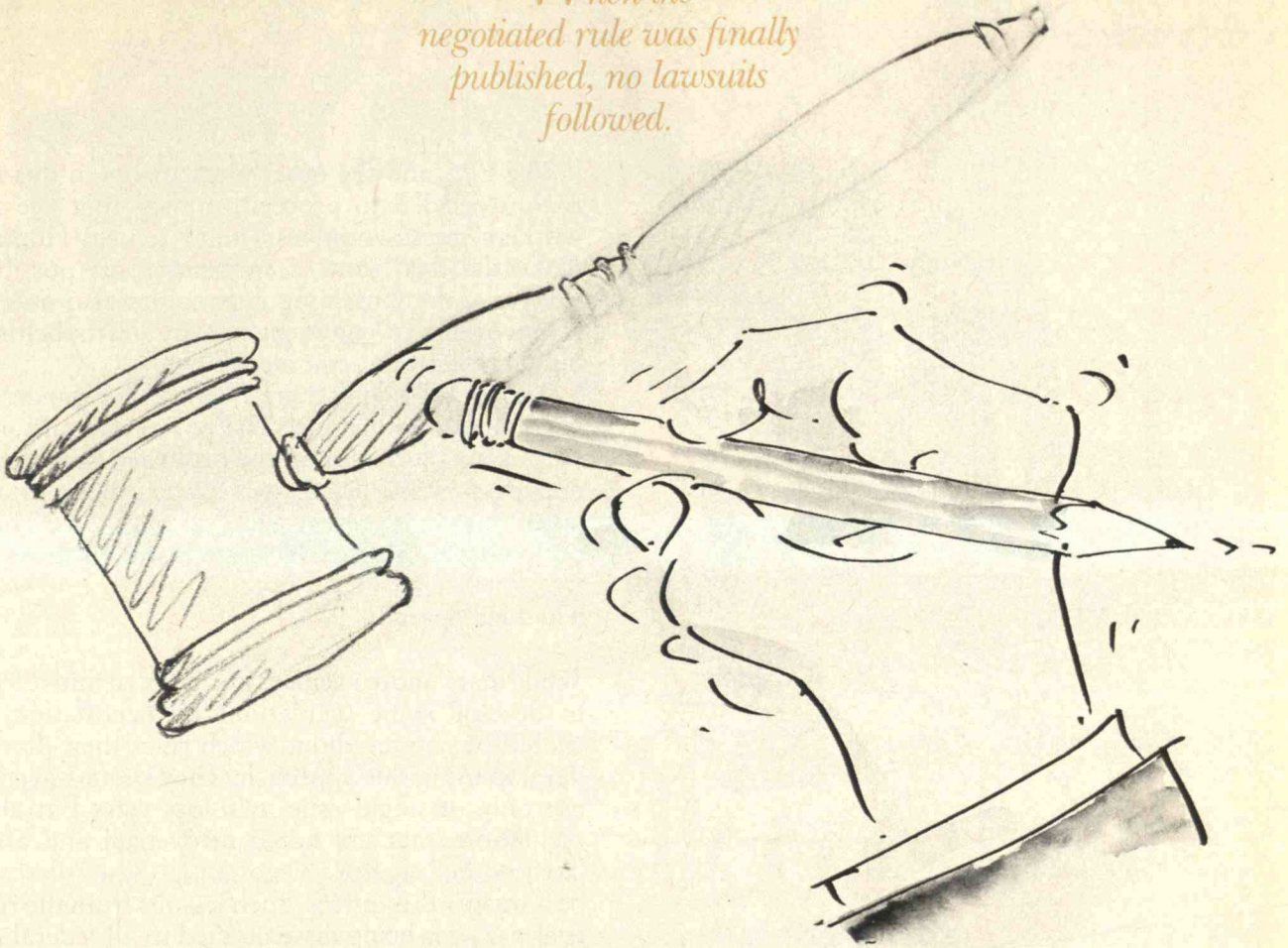
The EPA's technical staff also cheered the results. Staff scientists familiar with the details of pesticide regulation are convinced that the agency's statutory mandate to ensure technical soundness was upheld. These scientists believe that an extremely wise rule emerged.

Answering the Worrywarts

Regardless of such success, some observers still fear that informal negotiation may be a dangerous way to develop regulations.

For example, when people first learn about negotiated rule-making they often question whether certain interests that ought to be represented might not make it to the table because they are not well organized, don't have the resources to participate, or fail to find out about the negotiations in time. These criticisms would be more accurately leveled at the traditional rule-making process. At least the EPA's negotiated rule-making has included an outreach effort by an independent party—one of ERM-McGlennon's jobs in the second regneg demonstration. And funds can be used to reimburse participants' costs. Moreover, a negotiated rule is subject

*When the
negotiated rule was finally
published, no lawsuits
followed.*



to a full review and comment procedure. Finally, once the regulation is published, anyone can challenge it in court. Of course, the point of regulatory negotiation is to avoid courtroom battles, but the possibility of a challenge must remain as a safeguard.

David Doniger, senior staff attorney of the Natural Resources Defense Council, has urged that money from the resource pool be available for more than research and travel costs. He thinks the money should also be used for per diem compensation for those who need it. He has argued that negotiators representing relatively small, nonprofit organizations must be compensated, because their groups' resources can be stretched quite thin when a staff member participates in extended negotiations. He has pointed out that negotiated rule-making requires more staff time than merely preparing comments on proposed rules. While negotiators have not decided to use any funds for compensation so far, they always could if they wanted to.

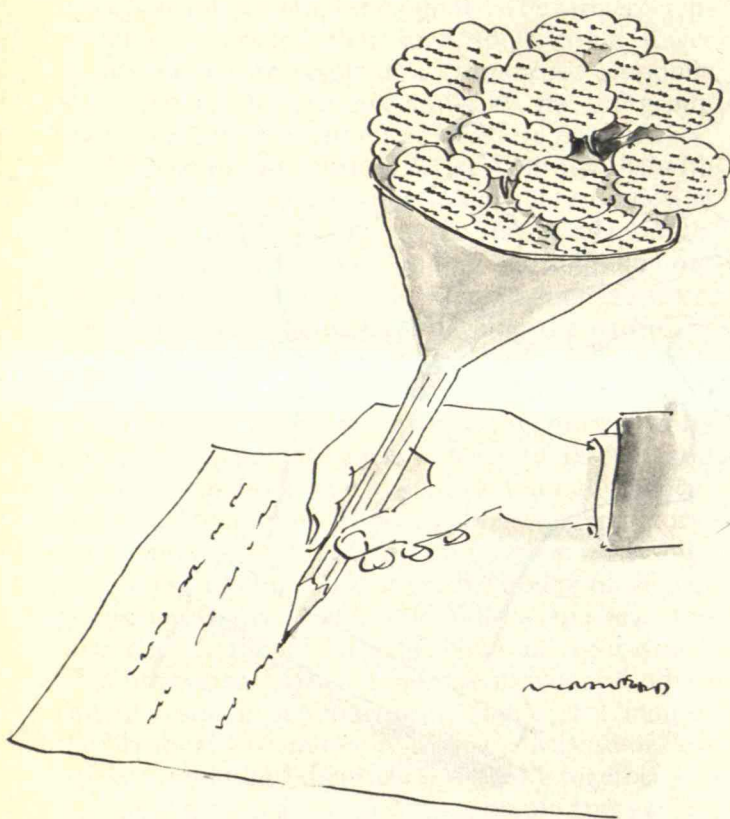
Some administrative law experts distrust negotiation because they believe it can lead one side to co-opt the other. They worry that individual partici-

pants might cozy up together and reach agreements that would not satisfy their organizations' memberships. If this happened, however, distraught members could criticize the drafted rules during the public review and comment stage. And groups are always free to set up their own review and comment periods before allowing their negotiators to agree to drafts. Moreover, every organization retains a direct veto over what its representatives have negotiated. Also, a group can replace its negotiators at any time if they fail to protect its interests.

Harvard Law Professor Richard Stewart and other administrative law experts believe that a government agency may compromise its authority if it agrees beforehand to be bound by a negotiated rule. But this criticism is beside the point. While delegating too much power to the negotiators could cause trouble, the participating agency can veto proposals in a regulatory negotiation.

Walkouts do pose a problem. The agency is left with a tough choice: should it continue the negotiations with the remaining participants, in the hope it will produce something close to consensus, or

*Interest in
negotiated rule-making
will undoubtedly spread.*



should it revert to the traditional approach? In either case, at least officials understand the interested parties' concerns better than if negotiations had not been attempted. Consider what has happened in the EPA's third negotiated rule-making demonstration.

The negotiating group, focusing on pesticide protection for farmworkers, lost seven of its eighteen participants earlier this year when the farmworkers' representatives announced after attending several meetings that they would not return to the talks. In their withdrawal statement, they said they were not given "the same respect and consideration" as agribusiness and agricultural chemical representatives, and that the proceedings were not conducted "in a fair, neutral and impartial manner." The EPA and the remaining negotiators offered to change facilitators, but the farmworkers' representatives declined. Actually, the farmworkers may have left for more reasons than they stated. They may have decided that they would lose an important organizing tool if they reached an agreement with their opposition.

The EPA and the other participants in this negotiation decided to proceed, hoping that the farmworkers' representatives would return. Hoping to make the final draft as acceptable as possible to everyone, the remaining negotiators also asked the farmworkers to comment on any drafts before the public review and comment stage.

Besides walkouts, there is one other danger with negotiated rule-making. The process should not be seen as a panacea for all the problems with the rule-making process. There will always be emotionally laden rules that present win-lose situations. The rule on low-level radioactive waste is one of those.

The Idea Spreads

While many more agencies are likely to find it fruitful to develop some regulations by negotiation, they should be careful about which rules they choose to develop using this approach. They should steer clear not only of single-issue, win-lose rules but also of regulations that are not controversial and are not likely to be litigated. Negotiating these rules would be a waste of resources. Such lessons from the regneg tests are now being disseminated to all federal agencies by the Administrative Conference of the United States, an organization that includes senior administrative staff from all the federal agencies.

The conference's backing for negotiated rule-making may explain why more agencies are showing interest now. In February, the Department of the Interior requested a facilitator for a regneg concerning air pollution that may result from oil drilling off the California coast. In May, the Federal Trade Commission announced it was considering negotiating a rule on the use of alternatives to lawsuits for resolving consumer complaints about warranted products.

For its part, the EPA has continued examining negotiated rule-making. Since March, the agency has been involved in a negotiated rule-making concerning performance standards to control air pollution from wood-burning stoves. It is also exploring the possibility of taking on at least two additional regulatory negotiations.

Interest in negotiated rule-making will undoubtedly spread. In less than five years, negotiated approaches could be used to develop as much as 10 percent of all rules.

(Continued on page 72)



Dropouts. The quiet killer of the American dream.

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In our large cities — Boston, New York, Detroit, Chicago, Washington and Philadelphia — the dropout rate is 35-50%.

The cost to society of the dropout crisis is staggering. More than half of the nation's prison inmates are dropouts — and it costs taxpayers up to \$25,000 a year to house a prisoner in a correctional institution. That total is higher than the cost of a year of education at either Harvard or Yale.

The Business Advisory Commission of the Education Commission of the States recently called on all of society — business, schools, civic organizations, labor and professional groups — to address the dropout problem. We as a nation cannot let one quarter of America's youth continue to drift toward hopelessness.

That's why the National Education Association has initiated a major new effort to rescue young people from academic failure. NEA has committed \$1.7 million to this effort — one dollar for every NEA member. We will devote \$700,000 to this war-chest against scholastic failure to Operation Rescue, our new program to combat the dropout and illiteracy syndrome.

The remaining \$1 million will establish an endowment to make educational excellence grants available to teachers for years to come. And we're asking other concerned groups — both inside and outside education — to join teachers in building this fund. Our aim is to begin funding local dropout prevention programs by the fall of 1986.

Our goal with Operation Rescue? We want to help cut the dropout rate in half by 1990.

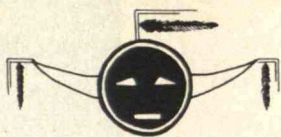
Our goal as an association? In over 128 years, that's never wavered. We stand for excellence in every classroom, for every child.

nea

National Education Association

THE SUBJECT IS EXCELLENCE





"Moving Those Indians into the Twentieth Century"

BY HOLLIS WHITSON AND MARTHA ROBERGE

THIS summer, the U.S. government may carry out the most controversial step in a 10-year program to relocate at least 11,500 Navajo Indians from disputed tribal lands in Arizona. Since Congress approved the relocation in 1974, about 988 Navajo families have been moved to modern government-built housing on other parts of the Navajo reservation or to housing in towns bordering the reservation. Another 1,200 families have moved off the land but have yet to receive housing. Many are living in abandoned housing or with relatives. U.S. law requires that the rest of the tribe living on the disputed land—about 350 families—be relocated by July 7, 1986.

Many of these Navajo are refusing to leave, and some talk of taking up arms to defend themselves against forcible eviction. Politicians have threatened to send in federal troops if the Navajo resist. If the forced relocation is completed, it will be the largest in this country since the internment of Japanese-Americans during World War II.

Federal officials say the relocation is a solution to a landownership dispute between the Hopi and Navajo tribes. The dispute, which has lasted decades, concerns almost 3,000 square miles—1.8 million acres—of flat, dry, starkly beautiful Arizona rangeland from which majestic rock bluffs, or mesas, rise. For centuries, the Hopi people have lived and farmed atop the mesas while the Navajo people have lived and grazed sheep on almost all the flatland below. With a gradual increase in Hopi livestock, particularly cattle, the Hopi have sought full use of the flatland. In recent years, they have often com-

plained that Navajo herders have been trespassing onto Hopi land.

However, non-Indian interests in coal seem to have been just as significant in this relocation effort as the conflict between the two Indian tribes. Peabody Coal Co., the largest coal company in the United States, already operates the Black Mesa strip mine, which is adjacent to the disputed land. The company is interested in exploiting coal reserves elsewhere on the reservation as well. Some of the key players in the relocation effort, including officials in the federal Bureau of Indian Affairs (BIA), have had close ties with Peabody Coal and the utilities involved in building area power plants. These officials may have helped fuel the dispute between the two tribes.

The relocation program raises even broader questions about the relationship between technologically advanced nations and land-based cultures that place little value on the Western idea of economic development. The Navajo hold their ancient tribal lands to be sacred. They believe that the Indian people are the spiritual custodians of these lands, and most are adamantly opposed to strip-mining.

Furthermore, many of the Navajo already relocated have experienced difficulty in acquiring adequate jobs and adjusting to their new environment. Their remarkable talents at subsistence-level farming and ranching are no longer marketable, and they have had little or no experience with a cash economy and a

technological world. Unfamiliar with utility bills, taxes, and other burdens of off-reservation life, these Navajo have been easy prey for loan companies. To pay off mounting debts and prevent foreclosure, approximately 40 percent of the relocated families have sold the homes provided by the government.

Social workers report drastically increased incidents of physical illness, alcoholism, and marital problems. For example, in one study Thayer Scudder, an anthropology professor at Caltech, says the Navajo have been using mental-health centers eight times as much as they did before the relocation program. (See "It Used To Be Home," page 52.)

Must the needs of modern society always conflict with those of a traditional indigenous culture? Can economic development be encouraged without destroying the Navajo way of life? Does the relocation violate moral standards? And finally, just who is the government trying to protect in its handling of this inter-tribal dispute?

A History of Exploitation

The forced relocation of Indian people has a long history in this country. The early relocations in the nineteenth century were military actions, carried out by the Department of War. But even after the Indians ceased to be a military threat to the United States, the government continued to forcibly relocate them so that white settlers could exploit their land. In 1886, the General Allotment Act partitioned millions of acres of Indian land into 160-acre plots, one for each family. It then sold off

*The U.S. government
is determined to relocate
11,500 Navajo Indians, supposedly
to restore Hopi land. But powerful
energy interests may lie at the
heart of the matter.*

the 90 million "surplus" acres—65 percent of all Indian land—for use and development by non-Indians. The Indians were never compensated for this loss.

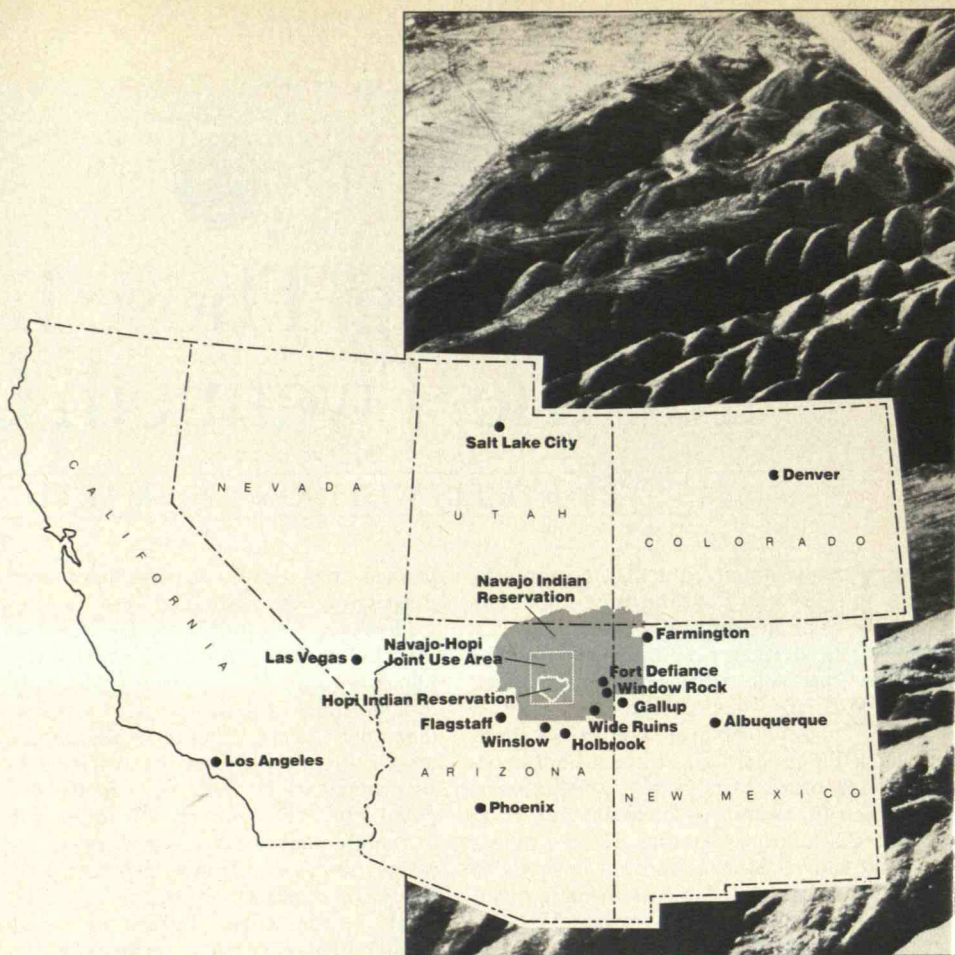
In 1832, the administration of U.S.-Indian relations was transferred to the Department of Interior, the agency that manages federal lands. By the late 1800s, the government had stopped treating the Indian tribes as sovereign nations. It had begun to claim ownership of all Indian lands, even those specifically reserved to a tribe by treaty. While this claim remains insupportable under international law, the U.S. courts have consistently upheld it. The government holds the land "in trust" for the benefit of the Indian people.

Within the Department of Interior, the BIA administers the land. The government requires that the BIA sign all leases between Indian tribes and private companies interested in exploiting natural resources on Indian lands. Under certain circumstances, the Bureau may enter into such leases without the consent of the tribe upon whose land development would take place. In effect, the same agency charged with protecting the Indians is also charged with developing their lands.

Creating reservations in the nineteenth century was the first step toward imposing colonial rule over the Indians. The notion that their land can be divided is alien to Indian culture. For centuries, the Navajo, Hopi, and other tribes of the Southwest had occupied and used particular areas without claiming to own the land itself. Moreover, the boundaries the government established for different reservations often had little relationship to the Indians' actual occupancy patterns.

The boundaries of the Navajo and Hopi reservations were no exception. The Navajo reservation was established over a period of years since the 1868 treaty between the Navajo tribe and the U.S. government. It excluded many areas of Navajo occupancy and included some areas of Hopi occupancy. The United States established the Hopi reservation without Hopi con-

HOLLIS WHITSON is an attorney in Albuquerque, N.Mex., where she practices natural-resource law. She has recently written on the Navajo relocation in the Arizona Law Review. MARTHA ROBERGE, an attorney in Accord, N.Y., was formerly with the Indian Law Project of Connecticut Legal Services. She is the co-editor of Rethinking Indian Law (Advocate Press, Inc., 1982).



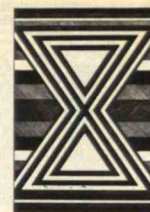
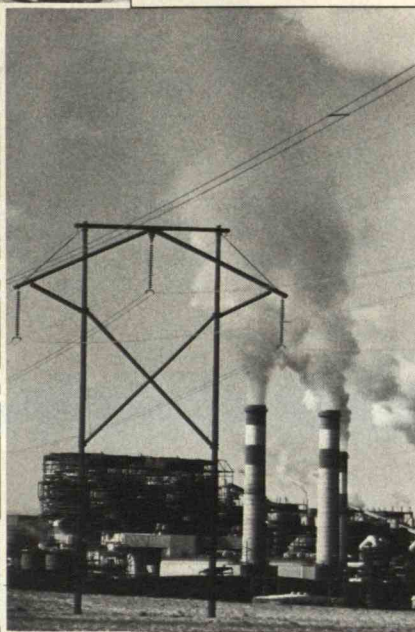
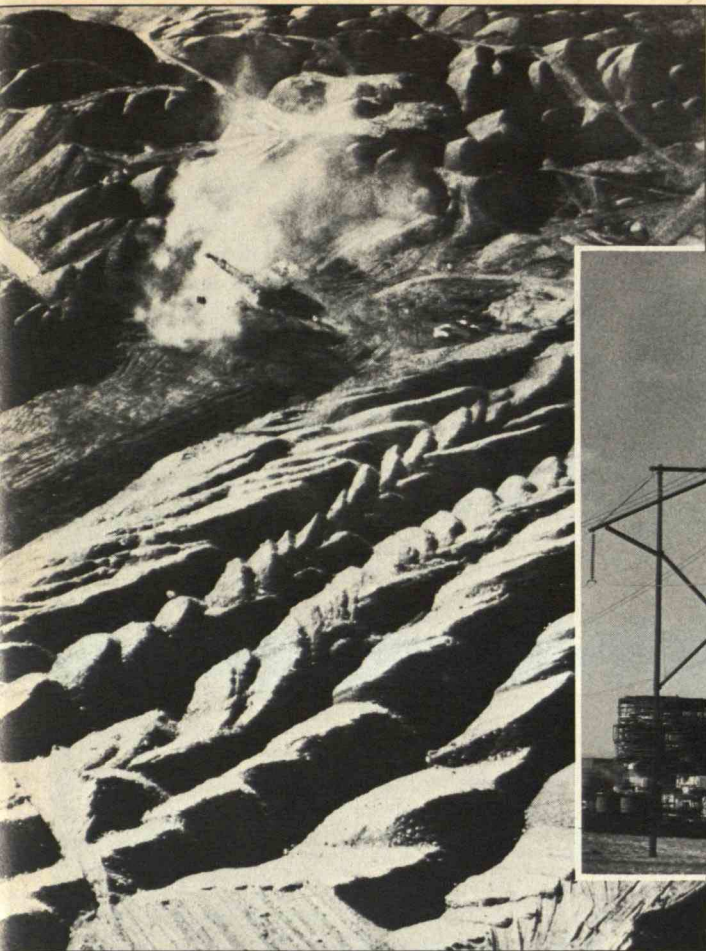
sent in 1882. It included areas of Navajo use and left out areas of Hopi use. In fact, except for an area of exclusive Hopi use known as "Grazing District Six," the Hopi reservation was primarily used by the much larger Navajo Indian tribe. The government later decided to call all the Hopi reservation outside District Six the Joint Use Area (JUA). The JUA comprises about 1.8 million acres of scrubby rangeland in the Four Corners area, which borders on the four states of Colorado, New Mexico, Arizona, and Utah.

The Energy Boom

For almost a century, the Navajo and Hopi peoples shared their territory without major tensions, disagreeing now and then over grazing land and scarce water resources. Non-Indians expressed little interest in these Indian people or their problems. But by the 1950s, government-funded mineral studies revealed significant coal and uranium reserves in the Four Corners area. In the JUA alone, an estimated 18 billion tons of coal lie within six feet of the surface—readily accessible for strip-mining. While no significant quantities of uranium have yet been discovered in the JUA, at least one prospecting lease has been granted to Dresser Minerals Corp.

From the early 1950s through the 1970s, an energy boom hit the Four Corners area. The coal-fired Four Corners electric generating station was built in the early 1960s. At that time, it was the largest electric generating station in the world. Coal and uranium mines, power plants, slurry pipelines, and electric power grids sprang up, providing energy to California, Utah, and populated areas of Arizona. Yet the Indian people—those who had leased their lands to the mine operators for jobs—received little economic benefit. In 1966, Peabody Coal signed a lucrative coal lease to the Black Mesa with the Navajo and Hopi tribes. For a total of 65,000 acres, the company paid \$100,000 to the Navajo but only \$10 to the Hopi. The peak royalty rate for both tribes was \$.35 a ton. In other areas, major coal firms pay landowners \$1.50 and more per ton.

The energy boom was stalled in the JUA mainly because of unresolved questions over who owned the land and had rights to the minerals beneath. Also, many of the Navajo on the JUA, together with some of the Hopi in District Six, vigorously opposed mineral exploration and strip-mining. For these Indians, mining was an affront to both their religion and culture, which are based upon harmony with nature. They found it hard to justify the ir-



The dispute between the Hopi and the Navajo involves almost 3,000 square miles of arid rangeland. This land is in the Four Corners region, so-called because it borders four states as shown on the map. Within the larger Navajo reservation (gray area) lies the Hopi reservation and the disputed Joint Use Area (JUA).

In the 1950s, studies found significant coal reserves in the Four Corners. The Peabody Coal Co. has strip-mined 65,000 acres next to the JUA (center photo), and local utilities operate a massive electric generating station nearby (photo at left). In the JUA, an estimated 18 billion tons of coal lie within six feet of the surface, but development has been stalled because of Navajo opposition and unresolved questions over who owns the land.

reversible damage that strip-mining could cause to land they need for survival. They also were concerned about preserving sacred sites and burial grounds.

However, some of the Hopis were interested in defining their mineral rights to the JUA. This group was led by the Hopi Tribal Council, which U.S. law formed in 1934. The government considers the Hopi Tribal Council the legal representative of the Hopi Indians, although not all Hopi people do. In fact, the first council was elected with only 14 percent of the vote.

The concept of voting is foreign to the Hopi people. The traditional method of showing disapproval is through abstention. Today, while many Hopis participate in the council government, many others refuse to do so. The Hopi Tribal Council continues to operate without a legal quorum, and in April 1986, one of the larger Hopi villages formally withdrew from it.

The Navajo Tribal Council was formed in 1923 by a U.S. government official, who found several Navajo Indians willing to sign leases and designate themselves as the Grand Council for the Navajo people. The Navajo Tribal Council, like that of the Hopi, has some legitimacy among its people, but it is not an indigenous governing body.

In the quest to define the Indians' min-

eral rights, the Hopi Tribal Council was represented by John S. Boyden. From 1944, when he was hired by the Hopi, until his death in 1980, Boyden was a central figure in the land dispute. He was a highly effective advocate for the Hopis, even though his law firm was 500 miles away in Salt Lake City. At times during the tribal dispute, Boyden's firm also represented the Peabody Coal Co.

Boyden's efforts on behalf of the Hopi began in the late 1940s. After failing to win a satisfactory ruling on the Hopi mineral rights from the Department of Interior, he succeeded in obtaining passage of an important bill in Congress. This bill essentially allowed the Hopi and the Navajo to sue each other in federal court over ownership and minerals rights to the contested land. When introducing the legislation in 1958, Rep. James A. Haley (D-Fla.) said that the BIA had made "repeated but unsuccessful efforts to settle the dispute which, with discovery of oil, gas, and uranium in the area, [had] become acute."

Once the bill was passed, the Hopi did sue the Navajo. And in 1962, a special three-judge federal court ruled that the Hopi were entitled to exclusive use of District Six, a 650,000-acre area in the JUA. The court, however, refused to divide the rest of the land and minerals. It ruled that

each tribe had a "joint and undivided" interest in the JUA.

The "Range War"

In the early 1970s, the Hopi Tribal Council approached both the federal courts and Congress, claiming that the widespread Navajo presence was depriving the Hopi tribe of its one-half "joint and undivided" interest in the JUA. A federal court ordered the Navajo nation to reduce its livestock by 90 percent—to half the grazing capacity of the disputed range. To pressure the Navajo into complying, the Bureau of Indian Affairs froze construction inside the JUA. This included home repair and the drilling of water wells.

With many of their sheep and cattle dying from lack of water and forage, some of the Navajo simply ignored the court order and drove their stock into District Six. The Hopi, in turn, hired a ranger to patrol their borders and impound Navajo stock caught inside.

The occasional border skirmishes were artificially elevated to the level of a range war, according to both Mark Panitch, a correspondent for the *Washington Post*, and Jerry Kammer, who wrote *The Second Long Walk*, a history of the dispute. By calling Evans and Associates, the Hopi's



Below: Every spring, the Navajo people meet on Big Mountain, one of the majestic mesas that tower over the flat Arizona rangeland. They discuss ways to fight the relocation of their tribe.

Right: A Navajo sheep herder protects her dwindling flock. Traditionally, the Navajo have raised sheep and cattle for wool and meat. They say the relocation would destroy this livelihood.



public-relations counsel in Salt Lake City, a TV crew could often arrange a roundup of trespassing Navajo livestock. And sometimes during a roundup, a representative of Evans would notify the local media. Newspaper and television reporters thus were on the scene to witness the impounding of the Navajo stock and the Navajos' threats of violent retaliation.

While Evans and Associates were representing the Hopi Tribal Council, they also represented a trade association of 23 utility companies that were building power plants and strip mines in the Four Corners area. The group was called Western Energy Supply and Transmission Associates (WEST), and according to an article Panitch wrote for the *Washington Post*, their mailing address was the same as that of Evans and Associates.

The "range war" had the desired effect—at least in the halls of Congress. In 1974, Boyden and the Hopi tribe obtained passage of the Navajo/Hopi Land Resettlement Act, which would divide the JUA land equally between the two tribes. Navajo living on the Hopi side would be re-

located at government expense into government-subsidized housing. But the Navajo and the Hopi would still share undivided mineral rights to the land. The final deadline for relocation was set for July 7, 1986, and the program was exempted from the federal law requiring it to prepare a statement detailing the program's environmental impact.

During the 1970s, the Navajo repeatedly fought the relocation in federal courts. But the courts invariably ruled that Congress has the ultimate authority to determine issues of Indian landownership.

By 1985, less than two-fifths of the families had moved from the JUA into new government housing. These were mostly the younger Navajo who were better equipped to handle off-reservation life. However, the relocation effort up to this point had cost the U.S. government \$62 million, said former Interior Secretary William Clark in a 1985 interview with the *Arizona Republic*. Clark estimated that moving all Navajo from the JUA would cost taxpayers a total of at least \$340 million.

A Web of Interests

Some observers have suggested that much of the Hopi success in Congress and the federal courts can be attributed to the Hopi's Mormon allies and various energy interests. Since the 1890s, the Church of Jesus Christ of Latter-day Saints has had a close association with the "progressive" faction of Hopis. Like the Mormon Church, such Hopis reject the traditional Indian worldview and encourage full development of the land. Today, Mormonism is a major Christian religion among the Hopi, and many Mormon Hopis have sat on the tribal council in the past 40 years. Boyden, the Hopi Tribal Council attorney, was a Mormon bishop.

The available evidence falls short of proving that either the Mormon Church or the energy companies directly campaigned for the relocation of the Navajo. However, the pro-development philosophy of the Mormon Church is consistent with the concept of relocation, and a surprising number of Mormons and other individuals with ties to energy interests



shaped the relocation policy itself.

To begin with, Stewart Udall, a prominent Mormon congressman from Arizona, sponsored the 1958 legislation that allowed the Navajo and Hopi tribes to sue each other over ownership of the JUA. In 1958, his cousin Calvin Udall worked for the law firm that, with Boyden, filed the suit for the Hopi tribe. Stewart became secretary of interior in 1961, and shortly after leaving the office in 1969, he joined his cousin's law firm, Fennimore, Craig, Allen, and McClennan. During the 1950s and 1960s, this firm represented Kennecott Copper, which owned Peabody Coal from 1968 to 1977.

In *The Second Long Walk*, Jerry Kammer, a former reporter for the *Navajo Times*, describes other people associated with the Four Corners energy development and the passage of the relocation act. For instance, Harrison Loesch, who worked as the Department of Interior's liaison to the BIA, strongly advocated partitioning the JUA. In 1974, Loesch left his position to work on the relocation legislation as the Senate Interior Committee's

minority counsel. In 1976, after the legislation had passed, he became a vice-president of the Peabody Coal Co.

Another central player was Rep. Wayne Owens (D-Utah), who introduced the relocation act in 1974. When he left Congress in 1976, he became a member of Boyden's law firm. And Jerry Verkler, staff director of the Senate Interior Committee, worked vigorously for passage of the bill. After it did pass, he joined the Texas Eastern Transmission Co., a WEST member that operates a large interstate natural-gas pipeline just south of the JUA. Finally, Rick Lavis worked on the legislation while a staff assistant to Sen. Paul Fannin (R-Ariz.), a member of the Senate Interior Committee. In 1976, he became a lobbyist for El Paso Natural Gas, which also operates an interstate natural-gas pipeline south of the JUA.

The connection between powerful energy interests and the Navajo relocation seems well documented. But some observers question why any company would want to remove the Navajo while they still had mineral rights. Wouldn't relocation

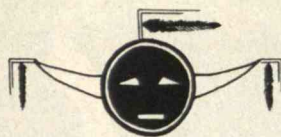
make the Indians resistant to signing coal leases on the JUA?

Not necessarily. In a 1983 interview, John Fritz, then assistant deputy secretary of interior, pointed out that the relocation would make the Navajo tribe more dependent on the federal government and thus more cooperative. Fritz painted the following scenario: if the Navajo Tribal Council refused to sign coal leases for the Hopi side of the JUA, the Department of Interior could always cut back on the Navajo's funds for health, education, and social services. This would put the tribe under enormous pressure. If they still refused to sign the lease, the BIA could step in and exercise what Fritz called its "trust responsibility," signing the lease on their behalf.

Fritz also offered an explanation for why Congress left JUA mineral rights "joint and undivided." He speculated that as long as the two tribes had competing concerns, the coal companies would be in a stronger negotiating position with both of them. He remembered a time in 1983
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John Lansas, head of the Hopi Badger clan, views a containment pond full of water and coal from strip-mining. In very dry areas, such facilities consume enormous quantities of water that Indians need for their cornfields.



"It Used to Be Home"

*"Let us have your life
and be on your way."
This is what we are
literally being told.
Nothing—not even white
man's medicine—can help
me. Livestock is what I need the most.*

*Now I am barely living—just breathing.
There is nothing to do. My arms are folded
[a gesture of helplessness]. It is like being told,
"Go over the hill. There is nothing here for you."*

—ROSIE FRANCIS, A NAVAJO



AFTER two decades of intense demands on their land from energy-resource developers, the Navajo are now confronted with an even more dramatic threat to their culture. The government is forcing them to reduce herds of twenty or thirty cattle per family to as few as eight per family. Lands on which they customarily graze their animals are being closed off to them by fencing and the threat of imprisonment for trespassing. Finally, at least 11,500 Navajo face relocation. Some may be moved to greatly diminished lands on the reservation. Others may be moved to towns bordering the reservation in Arizona and New Mexico, including Flagstaff, Winslow, Holbrook, Gallup, Farmington, and Page.

The federal programs threatening

the Navajo way of life are supposed to resolve a dispute between the Navajo and Hopi over who should control land they currently share. Legislation divides the right to live on the land between the two tribes. Congress initiated the programs in 1974, and U.S. courts have backed them up since. (See "Moving Those Indians into the Twentieth Century," page 46.) The government also claims that over-grazing by Navajo cattle damages the land, making it difficult for the Hopi to survive.

The Navajo are primarily pastoral. They raise sheep, cattle, goats, and horses and do some unsteady wage work. Traditionally, they do not adhere to title-based individual landownership, maintaining that the land should be used respectfully by all. The federal government issues them grazing

BY G. MARK SCHOEPFLE, ROSE T. MORGAN,
AND PEGGY FRANCIS SCOTT



permits allowing them to maintain a certain number of livestock on the land they have used for centuries. Because the Navajo are so attached to their land, the grazing permit has become in effect a certificate for local citizenship. Without it the Navajo way of life is impossible.

Forced relocation is devastating to many non-industrial cultures. It has affected the Khirgiz in Afghanistan, the Taureg in the Sahel, and other pastoral cultures throughout the world in much the same way it has affected the Navajo. In 1974 anthropologist Thayer Scudder, perhaps the leading expert on the subject, told a Senate committee, "Almost without exception people resist forced relocations. Where resistance fails and relocation occurs, the resulting trauma is very extreme. Indeed, it's difficult to imagine a more grievous insult to a community than to be forced to leave a beloved home."

Few officials in charge of the Navajo relocation question the severity of its effects. Yet the Navajo-Hopi Indian Relocation Commission and more recently the

Bureau of Indian Affairs (BIA)—the agencies directly in charge of the relocation—think that the impact can be mitigated. Some counseling, provision of housing, and other welfare safety-net services will supposedly allow the Navajo to adjust. However, no one knows how much "mitigation" is sufficient, how effective it is, or how long it will be required.

The BIA assumes that the stock reduction is necessary to restore the land for proper use by the Hopi. A case can certainly be made that the Navajo land is over-grazed. But the same case can be made for much of the rangeland throughout western North America. Also, in deciding that the Navajo must herd fewer cattle, officials make two implicit assumptions. The first is that the Navajo caused the over-grazing. The second is that Navajo do not know how to control grazing. The BIA decision to force the Navajo to reduce their stock is especially galling because the same sort of program was attempted 50 years ago and failed dismally.

The Precedent

Beginning in 1934, Roosevelt's New Deal administration encouraged progressives such as John Collier, the new commissioner of Indian affairs, to make badly needed improvements in education, land conservation, and reservation protection.

The Collier BIA forced the Navajo to reduce their stock for a number of well-meaning reasons. For instance, the plan was intended to help the Navajo modernize so they could be more productive participants in the U.S. economy.

At first, the government tried to buy up Navajo livestock. When the Navajo didn't want to sell, the government initiated a program that forced them to cut the herds by 50 percent.

The Navajo reaction dismayed the Collier administration. Violence broke out, some Navajo were jailed, political rights groups arose, and BIA plans for education and other developments ground to a halt. By 1937, Collier admitted that the program was "in a shambles" and held the rest of it in abeyance.

The effects of stock reduction could have eventually worn off. But the effects of a land-use plan forced on the Navajo at the same time caused permanent damage to their culture. Under the plan, grazing permits were allotted according to the estimated grazing capacity of the land in certain districts. District boundaries were established, and Navajo who crossed them with their herds were jailed.

These programs ignored the indigenous system of range management, which was well adapted to arid conditions. To lessen over-grazing, the Navajo had traditionally herded their livestock in varying directions

MARK SCHOEPFLE is associate director of legislation and planning at the Navajo Tribe's Division of Health. ROSE T. MORGAN is the administrator for academic affairs at Navajo Community College. PEGGY FRANCIS SCOTT is the director of the Navajo-Hopi Land Development Office, Navajo Tribe.



The people at left and the woman below are among the 11,500 Navajo that the federal government has been re-locating. Says an

anthropologist, "It's difficult to imagine a more grievous insult than to be forced to leave a beloved home."

every day. They had gone to different sites in summer and winter to take advantage of specific ecologies. In exceptionally dry years, Navajo would travel with their sheep, goats, and horses to visit more fortunate relatives as far as 150 miles away.

Because of the BIA programs, Navajo lost the means to support their households, which therefore shrank. This left insufficient labor to keep the herds properly circulated or to move them to seasonal sites. And the imposition of range-district fencing prevented Navajo from ever visiting distant relatives again.

Even officials noticed that the land did not improve. But never did the federal government doubt that stock reduction could help the Navajo. Officials concluded that Navajo resistance was culturally induced madness, and the best-known social scientists concurred. For example, Clyde Kluckhohn and Dorthea Leighton, two famous anthropologists of Navajo culture, called the Navajo opposition "an irrational response to a rational plan."

Livestock and Learning

The current stock reduction, part of the 1974 package that began the relocation, repeats and accentuates the damage caused by the New Deal programs. But because social scientists today work more closely with native people, many researchers now challenge the validity of relocation and across-the-board stock reduction. They point out that when the Navajo lose their livestock, they lose their self-sufficiency. While many Navajo have not had enough livestock since the first stock reductions in the 1930s, a family with about 30 head of cattle can survive periods of unemployment and other hardships.

Considerably more than economic security is involved. With the loss of livestock, families lose the most important means of teaching their children the Navajo ways of knowledge. Many Navajo are members of the Native American Church, various Christian denominations, or the Traditional ways. All these religious groups share the basic ethics and character-formation ideals of *K'e*, a complex term that refers to the way Navajos recognize their kin and interact. Love, warmth, generosity, clear thinking, and the ability to plan ahead are all part of *K'e*.

Without livestock, *K'e* is difficult to



maintain and teach, as Jennie Paddock attested:

My grandfather said to me, "This is what you will make a living with. Sheep and livestock will be your livelihood." He said, "In the future you will progress with the rest of us and the rest of the people. Your children and grandchildren will be provided for by this livelihood."

Roger Attakai is the father of an 11-year-old girl:

My daughter owns some goats. She requests me to teach her the knowledge of making her living. For example, she will rise up early at dawn. She feeds the lambs during lambing season. By means of this she cares for her goats and loves them. That love and awareness develops within her, and it eventually becomes her thought. In later life she will be friendly and not lazy. She develops a sense of belonging.

Some Navajo think that without livestock to come home to, children will take up lives of drunkenness and alienation. Frank Goldtooth feels that this happened in his family:

My children used to have things to do. They used to enjoy caring for the livestock—riding and rodeoing. Now the

horse trailers are sitting idle. The children stopped coming around now. They used to come all the time and spend the weekend there when we had livestock. It used to be home then.

My son worries about us now. He used to visit often. Now he probably doesn't want to be reminded about how much my heart hurts. Now they would simply rather go to town to drink and act like they have no home. They lose all motivation to pursue some kind of good life, because they have lost their livestock.

The disappearance of traditional culture makes it more difficult to master modern culture. The Navajo consider the qualities embodied in *K'e* crucial to doing well in mainstream schools. They say that the disruptions being forced upon them have caused their children's school performance to suffer.

The young adults reflect the descriptions by the elders. Jerry Goldtooth is a 30-year-old Navajo who lives in Winslow rather than at his ancestral home where he was interviewed. He tells a common story:

All we can do now is tough it out. We are allowed only two sheep or horses. Yet there are four brothers and sisters. All they had is livestock. I feel like I'm worried about something all the time.

Some of us with high school degrees go

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"Moving Those Indians into the Twentieth Century"

Continued from page 51

when the Peabody Coal lease on the Black Mesa was being re-negotiated to increase royalties to the two tribes. Navajo and Hopi representatives were close to reaching an agreement, but then lawyers for the Hopi tribe derailed negotiations. They warned the Hopi Tribal Council that their representative was negotiating away Hopi rights in the JUA. According to Fritz, the scare tactic worked: the tribes never signed an agreement on a new lease.

Congress may have left mineral rights joint for other reasons. The precise location of all JUA mineral resources is still unknown, although most of them appear to be on the Navajo side. Congress and the energy companies may not have wanted to divide these unknown resources. Perhaps all concerned thought that the task was best left until after relocation of the Navajo.

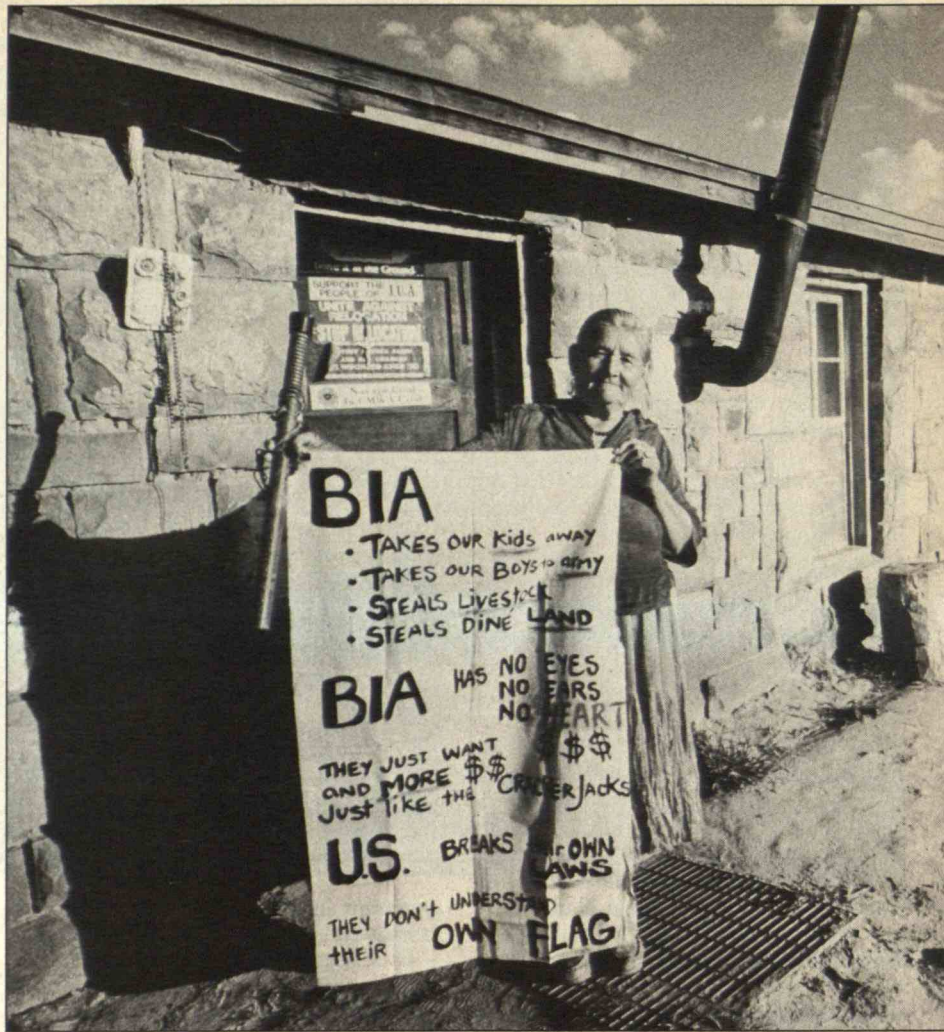
Whatever the motives behind the 1974 act, some 900,000 acres of undeveloped land containing mineral resources will be available once the Navajo are relocated. It is rather doubtful that the Hopi people will abandon their mesa villages to live on the undeveloped flatland. This could be why in 1985 Ivan Sidney, chairman of the Hopi Tribal Council, told the *New York Times* that "mineral development for the future is probably part of the plan."

"A Cultural Rebirth"

Government officials now working on the relocation insist it is a just solution to an age-old tribal dispute. After all, they say, the government is only returning land to a tribe that has been denied it for years.

If this is true, it is certainly an anomaly. Congress rarely enacts substantial programs to benefit Indian tribes, and it has never passed a law requiring that non-Indians relocate to restore Indian land. Could anyone imagine the government attempting to relocate 11,500 Anglos or 11,500 urbanized Blacks for such a reason?

Many government officials also insist that the relocation will actually benefit the Navajo. In an early-1983 brief submitted to members of Congress, Relocation Commission chairman Ralph Watkins called the program a "cultural rebirth." Georges Ramonas, legislative aide to Sen. Pete Domenici (D-N. Mex.), has said that it is simply "moving those Indians into the twentieth century" a bit faster than they





According to federal law, all Navajo in the disputed area must be relocated by July 7, 1986. But many are refusing to leave. Above: Katherine Smith, pictured here outside her home, is one of the leaders of the resistance. Left: Until relocation is completed, federal officials have put up a barbed-wire fence to separate Navajo and Hopi lands.

might otherwise move.

Maybe the non-Indian world sincerely believes that the traditional Indian culture is doomed because it is technologically "backward." After all, the U.S. government is not the only regime to use that excuse for relocating indigenous Indians. In Nicaragua, for instance, the new Sandinista government has relocated over 15,000 Miskito Indians from ancestral villages to state farms. Although national-security claims supposedly justified the early relocations, the Sandinistas have since admitted they have been trying to integrate the Indians into the national economy. Ironically, the Reagan administration continues to criticize the Sandinista policy at the very moment that Congress and the Department of Interior are pursuing the same policy here.

Whatever the motive, such policies have a common result: Indian lands throughout the world are sacrificed in the name of technological progress. The Cree, for instance, lost their land at James Bay, Ontario, because of hydropower development, the Yananomi in Brazil because of gold and tin mines, and the Dene in northern Saskatchewan because of uranium mining.

The plight of indigenous people worldwide is beginning to capture the attention of the international community. A United Nations Working Group on Indigenous Populations was formed in 1982. This group is considering standards that would prohibit forced relocations of the type the United States and Nicaragua are now carrying out.

While laudable, these standards will almost certainly be opposed by many member nations with indigenous populations. Both Nicaragua and the United States have made it clear that other governments have no business criticizing their Indian policies. So even if the U.N. group's standards become international law, they will only have the force of moral persuasion.

National Solution

The solution to the Navajo's dilemma can only come from the U.S. government. Officials must immediately cease relocation efforts and help the two tribes work out their differences. The Hopi tribe should be compensated by the U.S. government for the land now occupied by the Navajo. The Navajo should be similarly compensated, and the Hopi communities living on Na-

vajo land should be allowed to remain where they are.

Perhaps this approach would not result in the most efficient use of the land. But the United States already has a strong precedent for protecting the environment and public health at the expense of specific technological projects. In recent years, such concerns have kept state and federal officials from approving hazardous-waste sites and allowing the construction of power plants. Why is technological progress considered a necessity in this case?

Some policymakers in favor of relocation argue that even if the Navajo were allowed to remain on their land, they could not continue their traditional means of making a living. These policymakers claim that the grazing land on the JUA is exhausted and can no longer support sheep and cattle. This may be true. But since when is forced relocation a solution to overcrowding and insufficient resources?

Instead of physically relocating the Navajo, Congress should attempt to improve the Indian way of life on the JUA—for both the Hopi and the Navajo. The millions of dollars now being spent on relocation would be much more wisely used to develop grazing techniques that help conserve water on the arid rangeland. These funds could also help provide adequate schooling and housing within the JUA and generate jobs that utilize the Indians' considerable skills in range management, arid agriculture, and fine crafts. In addition, the government should make sure the 5,000 Navajo already displaced have adequate housing and the option to return to the JUA if they wish.

There is not only a moral imperative to allow the Navajo to remain on the JUA, but a practical imperative as well. Western society has much to learn from cultures that strive to live in harmony with their environment rather than dominate it. If the Navajo are relocated, an important part of their land-based culture will be lost.

Of course, some Indians may elect to develop their natural resources or leave the reservation for jobs in a modern economy. The point is that their indigenous culture should be respected. The Indian people should be allowed to develop at their own pace and in their own way. We need a much fairer and more humane Indian policy—one recognizing that the Indians are already in the twentieth century. □

I N T E R V I E W

Richard DeLauer ON DEFENSE

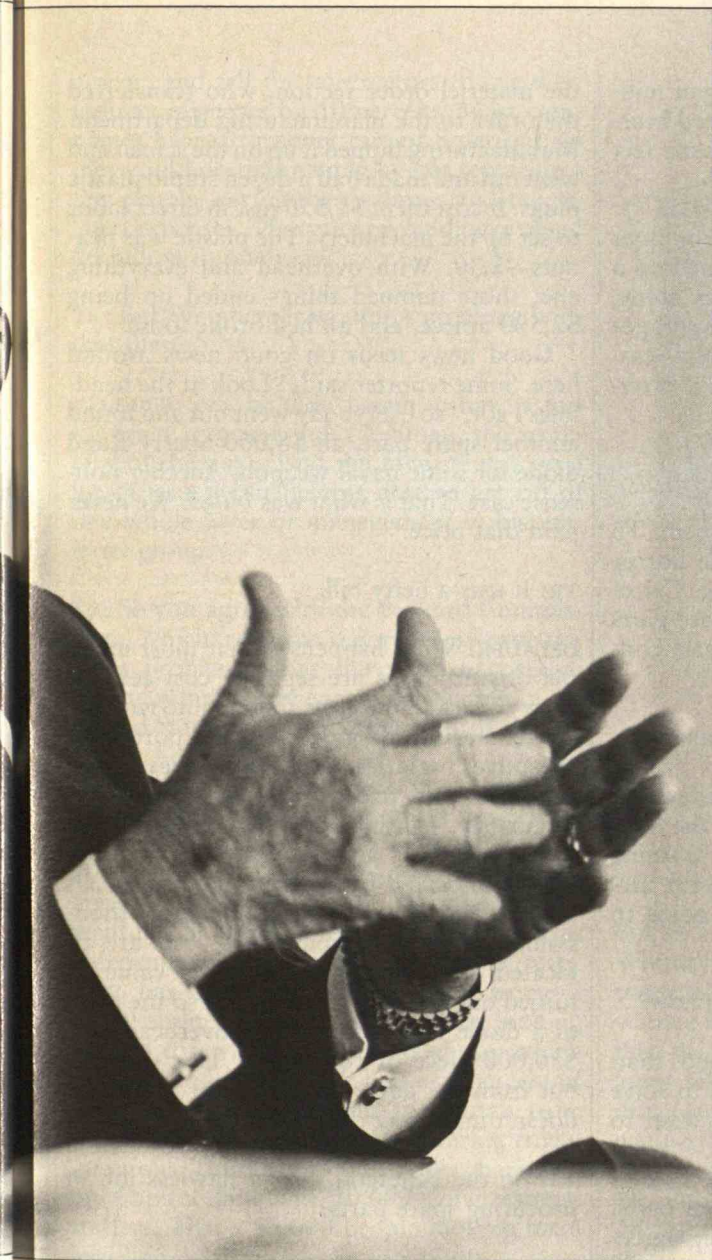
DEMOCRACIES have historically let the military establishment decide the details of weapons programs. Of course, the public has played a broad role in setting military policy. Strong pacifist sentiment in the United States prior to World War II appeared as political opposition to defense appropriations, military aid to Western Europe, and the draft. There was even a public debate during the twenties over the need for a U.S. Air Force. But politicians did not issue campaign leaflets supporting or opposing the B-17 bomber.

A shift began to occur after the war, perhaps because of growing concern about technology itself largely stemming from the advent of the nuclear age. Public fears about strontium-90 in milk from atmospheric testing culminated in the Limited Test Ban Treaty of 1963. When President Lyndon B. Johnson proposed deploying an anti-ballistic missile (ABM) system, a parade of scientists criticized the idea, and much of the public opposed stationing nuclear-tipped interceptor missiles in urban areas. President Richard M. Nixon negotiated the 1972 ABM Treaty, but he did deploy a limited ABM system at a missile site in accord with the treaty.

Today missile defense is back on the public agenda with the controversy over the Strategic Defense Initiative (SDI). Politicians campaign for or against the B-1 bomber, the MX missile, and the nuclear freeze. Public debate over weapons programs extends to conventional arms. Front-page newspaper articles describe how the Pentagon bought \$2,500 plastic plugs for the legs of a navigator table and announce that in a test the radar of the DIVAD (division air defense) gun, also known as the Sgt. York, detected an outhouse rather than a helicopter.



As head of weapons acquisition and R&D at the Pentagon from 1981 through 1984, Richard D. DeLauer found himself in the midst of many of these controversies. A native of Oakland, Calif., DeLauer received his Ph.D. in aeronautics and mathematics from the California Institute of Technology and worked for 15 years as an aeronautical engineer in the U.S. Navy. After joining TRW, Inc., in 1958, he rose to become executive vice-president with responsibility for systems and energy. He oversaw the firm's business with the Defense Department and



NASA, as well its commercial energy business—supplying oil-drilling equipment, for example.

Beginning in 1971 he served as a member of the Defense Science Board, which advises the Defense Department on weapons, and in 1977 he wrote a major report on deficiencies in the weapons-acquisition process. He worked under Gov. Reagan in Sacramento and came to know some of the Reagan team from California, but not Defense Secretary Caspar W. Weinberger. A search committee proposed him as undersecretary of defense for research and

The former Pentagon R&D chief tells why missiles that miss targets during testing are a legitimate part of buying weapons, and why the inspector general is a waste of money.

engineering, which also included responsibility for defense acquisitions.

Some of the Reagan team complained, since in California he had been known as TRW's house Democrat. He had in fact voted for Franklin Roosevelt. However, computer searches revealed that in recent decades he had contributed to many Republican causes. "They decided that this guy's more conservative than Genghis Khan," says DeLauer. "So the president appointed me, and I was on the job by the first of March 1981." The reason he left in 1984, he insists, is merely that "I ran out of steam. Four years is enough. How can we let the freshmen in if the seniors don't get out?"

It is probably mistaken to see DeLauer, in his role at the Pentagon, as partisan Republican or Democrat. He agrees with William F. Perry, his predecessor in the Carter administration, on many subjects, and he generally sees himself first and foremost as an engineer. That does not make him reluctant to state his mind on subjects ranging from the *New York Times* ("they're not interested in the whole truth") to Sen. William Proxmire ("the biggest fly in the ointment" of defense procurement). Perhaps DeLauer's overriding concern is that detailed public debate over weapons programs has gone so far as to hamstring the Pentagon and foster inefficiency.

Technology Review managing editor Jonathan Schlefer and senior editor Sandra Hackman recently interviewed DeLauer in his office in Arlington, Va., where he has established The Orion Group, a company that advises firms on how to manage their operations and acquire both defense and nondefense business. An edited version of their conversation appears on the following pages.



*Even if you're
99.44 percent
pure, you've
still got the
potential for
8,000 horror
stories a year.*

TECHNOLOGY REVIEW: As the Reagan military buildup got underway, we started hearing horror stories about \$2,500 plastic feet for tables. How could that happen?

DELAUER: The Defense Department does from 14 million to 16 million transactions a year. Even if you're better than Ivory Snow, which is 99.44 percent pure, you've still got the potential for 8,000 horror stories a year. Yet we haven't heard 50. It's a minor problem.

TR: But there *were* horror stories.

DELAUER: Yes, and we should fix them. To understand the problem behind the horror stories you have to go back to the Carter administration. They didn't buy spare parts because of high inflation and budgetary constraints.

TR: They didn't buy any in four years?

DELAUER: Not enough to make a difference. And they didn't really provision the new equipment, such as the advanced warning communication systems (AWACS) for airplanes. I told Weinberger, "We're going to have a problem."

TR: The Pentagon is filling that gap now?

DELAUER: Yes, but nobody understands that. Nobody wants to write about how to solve the spare-parts problem. They just want to write about a few horror stories.

To understand these stories, you have to know how the Pentagon buys spare parts. Normally, there is a "basic ordering agreement," a contract for a company to supply spare parts and services. It has all the boilerplate—how to test them, how to deliver them, how to be an equal-opportunity employer. When the Pentagon sends an order, the company bills for what it charged the last time, plus any adjustments for inflation and for what it has to do differently.

We ordered a spare part from Boeing for the AWACS—the plug for the leg of a navigator's table. A piece of plastic. Boeing didn't have any in stock, and didn't try to figure out the cheapest way to get them. That takes a little management skill. Instead the order went to some clerk on a computer screen in

the materiel order section, who transferred the order to the manufacturing department. Manufacturing flipped it up on the screen and went out and made half a dozen stupid plastic plugs. It cost them \$1,550 just in direct labor to set up the machinery. The plastic was peanuts—\$.30. With overhead and everything else, those damned things ended up being \$2,500 apiece, and all hell broke loose.

Good news feeds on good news around here. Some reporter said, "Look at the headlines I got," so everybody went out and found another spare part, an \$8,000 Sperry-Rand diode for some naval weapon. Another nonsense case. That is what was *billed*. We never paid that price.

TR: It *was* a hefty bill.

DELAUER: What happens is that most materiel organizations are separate cost centers. They collect all the costs that go into running the center, including overhead—a portion of executives' salaries, clerks' salaries, vacation, pensions, packaging, inspection, space occupancy, lighting—and at the end of the year those costs are distributed. Sometimes they're allocated by item. If the center sells 10,000 items a year, each gets one-ten-thousandth of the cost. Sometimes costs are allocated as a percentage of sales value. It turned out Sperry did it by item, so the price of a diode reflected as much overhead as a \$50,000 piece of equipment. That's dumb, but from the government's point of view it doesn't make any difference.

TR: So the Pentagon does a flawless job of procuring spare parts?

DELAUER: No, but the problems are the hole in the doughnut. What I wanted to do, but I didn't have the muscle, was to cut down overhead, which is the doughnut. Of the \$100 billion the Defense Department spends every year on acquiring weapons, about \$60 billion goes for indirect costs. That's comparable to U.S. industry in general. I suggested that Secretary Weinberger drag in the chief executives of the defense contractors and tell them we're spending too much money on overhead: we can cut the percentage because we're producing a large number of weapons. I urged him to cut Defense Department indirect expenses by 10 percent in

a year, and tell the contractors to cut their indirect expenses by 10 percent. Most companies have a turnover rate of 8 percent, so they could do that mainly by not replacing a few people, saving their salaries and the related expenses. That effort would have saved \$6 billion in one year.

TR: But Weinberger wouldn't go along with that plan?

DELAUER: No, he didn't seem to have a feel for what it meant. John Lehman, the secretary of the navy, isn't my favorite guy on a lot of issues, but he was able to get rid of one whole layer of management in his materiel group.

TR: So you agree with the Packard Commission, which recently reported on procurement problems, that the indirect costs of buying weapons are enormously larger in the United States than in Western Europe?

DELAUER: Yes. I think those costs could be reduced 25 percent in five years if we were willing—and when I say “willing,” I mean everybody, including Congress. It was Congress that insisted that the Defense Department install an inspector general (IG) and an independent director of operational tests. That has only made the problem worse—5,000 auditors in the IG's office are looking around for waste, fraud, and abuse, which amounts to less than one-half of 1 percent of procurement. We spend too much time watching one another and answering trivial questions. There are 15,000 media characters on Capitol Hill and 20,000 congressional staffers. That's 35,000 people looking for a headline.

A Swamp of Socialism?

TR: The media certainly told some good stories about you. When you opposed competition in buying an engine for the F-18, the *New York Times* editorialized, “DeLauer just wants to maintain the Pentagon as a comfortable swamp of socialism in a free-market country.” How do you explain that?

DELAUER: Those writers at the *Times* don't know what they're talking about. They don't understand competition. I support the hell



out of *real* competition. Take the Pratt & Whitney F-100 jet engine. The air force had that engine for the F-15 and F-16 fighters and wanted to have some competition, so it modified the two aircraft to take GE's F-110 engines also. Now the two companies are in direct competition for supplying replacement engines.

TR: But you opposed competition on the F-18 engine.

DELAUER: What the navy did with the GE F-404 engine—which is in the F-18 as well as modified somewhat for the B-1 and the advanced-technology bomber—was another story. The government told GE to give all its drawings and processing data for the 404 to Pratt & Whitney so that company could bid to build it too. I was dead against that scheme.

The one high-tech area in this country that's really competitive is commercial jet engines. We beat the pants off everybody in the world. It's hard for an engine manufacturer to segregate the engineers working on mili-

What I wanted to do, but didn't have the muscle, was to cut down overhead, which is the real problem.

—News and Comment—

Pentagon Decision-Making Comes Under Fire

Critics inside and outside the Pentagon say that senior officials have made some ill-advised weapons purchases

Every 2 weeks, on the average, five men meet in a conference room on the first floor of the Pentagon and decide to spend anywhere from \$100 million to \$1 billion on a new weapon.

When Weapons Flunk

The Defense Department is gearing up for its biggest peacetime spending program, but its ability to buy the right weapons at the right cost looks as uncertain as ever. The General Accounting Office now documents the troubling history of a big weapons project, the Navy's plan to spend \$40 billion to buy 1,377 new F-18 warplanes.

regulations, rarely scrutinized during the

severe, but fixable, problems with it as a fighter. As a bomber, the F-18's large size and weight give it roughly half the range of the A-7. That means \$3 billion aircraft carriers would have to sail 200 miles or more closer to danger for the new planes to strike at their targets.

Although the F-18 flunked realistic tests, it got ordered into production anyway. The Navy says it will compensate for the loss of range by putting extra tanker planes aboard the carriers. But the

from a process standpoint, it is ioning almost exactly as you recom- In the case of DIVAD, the re- documents were provided well in e of the meeting and the issues (early though) the test data available were preliminary in nature." ditional audits by Sherrick's of- ily made available to Science

only one of inadequate rs. In a 1983 s. for exam- curate data viet threat uncil when only docu- as the one posed, the cluded. cil went weapons complete while audits by report

ARMY DATA ON GUN CALLED MISLEADING

Faults of Antiaircraft Weapon Were Reportedly Obscured

By WAYNE BIDDLE

WASHINGTON, Sept. 28—The Pentagon's antiaircraft gun program today was found to have been misled by faulty test results in deciding to produce the Army's Sergeant York antiaircraft gun.

In testimony before the Senate Governmental Affairs Committee, Joseph W. Sherrick, the inspector general, said that Defense Department officials had used oversimplified and misleading test results in deciding to produce the Army's Sergeant York antiaircraft gun.

He said the Army had given Defense Department officials charts purporting to show that the gun possessed "a high level of effectiveness at long range" and "reacted rapidly to threats. These charts, he added, "were oversimplified and misleading and based on a selective analysis of the results of field trials."

They also used several overly optimistic performance figures.

Agency Finds a Vast Excess in Arms Costs

By WAYNE BIDDLE

WASHINGTON, March 13—The Reagan Administration may have underestimated the price of its five-year military buildup by hundreds of billions of dollars, the General Accounting Office said in a report today.

The report says the cost of the program's cost for weapons from 1984 through 1989 was initially placed at \$100 billion. But the final cost of the program will cost \$200 billion, the report says.

It said each fiscal year, the report said, the 1984-89 weapons program cost \$47.7 billion.

What this means is the Congress must make some real decisions today on what weapons systems we are going to have in the future if we are going to have any impact on defense spending and deficit reductions," said Lawrence H. White, the ranking Democrat on the Senate Budget Committee.

Meanwhile, Richard B. DeLoach, the defense department's top official, in testimony before a Senate panel today said he was overreliant on the data that he was given.

The two military budgets I can make the idea of no new starts. Mr. DeLoach said, the Alaska question from Ted Stevens, the Alaska Republican, who heads the Senate Appropriations Committee, "substantial" in defense, "try to get money for arms that have not yet entered production."

Mr. DeLoach mentioned the Navy's shipbuilding program, scheduled to begin construction later this year at a cost of more than \$1 billion for the first ship, and the Air Force's \$1.2 billion modernization program, for which the Air Force wants \$25 million in development money, a project that could be a deal but in the next fiscal year. He did not appear to be suggesting a cancellation of any weapons program.

itary and civilian projects. The engineers working on fuel efficiency work on fuel efficiency. The principles are the same, the metallurgy is the same, and the manufacturing is the same. So it's difficult to tell what belongs to the government and what belongs to GE. If the government can send companies' information to anyone it wants, that's socialism.

If I told the *New York Times* that it couldn't publish a story unless it gave it to the *Washington Post* because I wanted to increase competition, they'd say I was out of my mind. But that's what the *Times* was advocating with the GE 404 engine. If you make a company give up its intellectual property, it'll outfox you in the long run to keep its competitive edge. GE would respond by taking its best engineers and isolating them on the commercial side. That's where engine manufacturers really make big money.

What the navy should have done is give Pratt & Whitney a contract to develop a different engine to fit into the F-18—the company would have been very happy to do that. Or the navy could have modified the F-18 to take an existing engine made by someone other than GE. That's real competition.

TR: You were in favor of competition on the

AMRAAM [air-to-air] missile.

DELAUER: But not the way the air force did it. The issue was not whether we could design a missile with a "fire and forget" guidance system. We knew we could. The real issue was how much it would cost to manufacture the missiles.

We had a competition among a bunch of contractors and narrowed it down to two, Raytheon and Hughes. And then we spent another 150 million bucks on a stupid "fly-off" to choose one, to say who was first among equals. So the companies launched six missiles each, and some hit their target and some didn't. Hughes was chosen, but Raytheon was kept in the running.

We should have told those two companies which features we wanted in the missile and given them the \$75 million apiece to figure out their plant automation, materials, and vendors and come up with the cheapest manufacturing plan. They'd have to show how they modified the design to save money while maintaining performance. Or if they degraded performance, they'd explain the trade-offs. And then we could see which one could really save the air force money on the AMRAAM—we're going to buy 20,000 of them. We could have split the buy, as we did with the F-100 and F-110 engines.

TR: Sen. Proxmire [D-Wis.] says that only 40 percent of weapons are produced competitively.

DELAUER: Proxmire is the biggest fly in the ointment—he hasn't helped defense procurement for a decade. There are two problems with the 40 percent figure. First, when programs funded for only one year at a time are renewed, they're counted as noncompetitive, even though competition over the original contract may have been fierce.

Second, the 40 percent figure applies only to the level of the prime contractors. It doesn't take into account the competition that occurs at lower levels. For example, FMC Corp., the prime contractor for the Bradley fighting vehicle, spends only 15 percent of the total costs of producing it. The rest goes for parts from outside vendors. A good prime will generally have two vendors for each part, awarding more business to the one with the lower price. Hughes has found

The real issue was how much it would cost to manufacture the weapons, not whether they would work.

that for every dollar it spends on setting up competing vendors, it saves 12 times that on ultimate costs.

Now Congress has decided it wants to increase competition. So to procure spare helicopter blades, say, the Pentagon asks the prime for the data package for them. The Pentagon then puts out a *Commerce Business Daily* notice and a request for proposals so companies can bid on producing the actual blades. The government negotiates this subcontract instead of letting the prime do it, and that's called competition. It adds to overhead.

TR: But do the primes have to pass along to the government the savings from competition in subcontracts?

DELAUER: Sure they do. A prime might not have to pass the savings along for a one-year fixed-price contract, but it would for the following year. The government has access to all the costs on all contracts of companies it does business with—even their commercial contracts. Of course, the opportunities for mischarging are broad, but with computers and those 5,000 extra auditors in the IG's office it should be easy to spot mischarges. That's what all the government auditors are there for, and they should jump on companies that mischarge.

Most fixed-price contracts include a target price and a ceiling price. Companies that keep their costs below the target price retain a certain percentage of the savings. In a 50/50 contract, the government and the company split the savings, and each pays half of the higher costs if the contractor overruns the target price.

Many contracts aren't fixed-price, and in those cases the government either shares in any savings or collects them all. Take the DIVAD anti-aircraft gun, which was a cause célèbre. The inspector general stated in a draft report that the army had approved its \$500 million contract with Ford, the producer, before completing all the pre-award audits of the subcontractors. Since the IG found that the department had agreed to pay \$80 million of these subcontracts above the audited costs, the headlines read "Ford Has \$80 Million Windfall Profit."

I blew up and insisted on meeting with Deputy Defense Secretary William Taft and

Joe Sherick, the inspector general. There wasn't an \$80 million windfall: the IG didn't count the cases where the company had negotiated with subcontractors to pay less than the pre-award audit. There was also a cost-sharing clause in the contract. I told Sherick, "Do you realize that if the prime comes in under costs, the government gets 80 cents out of every dollar saved? So if there *were* an \$80 million windfall profit, the government would get \$64 million of it?" He corrected the error in the final report, but who reads final reports?

Weapons That "Fail" Tests

TR: The inspector general also charged that you and the other members of the Defense Systems Acquisition Review Council (DSARC) at the Pentagon decided to go ahead with the DIVAD without complete knowledge of the test results.

DELAUER: Again, that was a draft report that turned out to be nonsense. First, no one ever bothered to explain that the DIVAD program was a creature of Congress. The army had been criticized for taking 17 years to field a weapon. So during the Carter administration, Congress decided to make the army use existing components to get a new air-defense system deployed quickly. The army took the chassis of the 109 howitzer, the radar from the F-16 fighter, and an existing gun. The key was to produce the software that would enable these components to work together. We awarded the contract to Ford to integrate the system, and we wanted to test it as early as possible to see if the concept was feasible.

When DSARC reviewed the DIVAD in 1984, I wanted to know whether we were indeed converging on a solution. I didn't expect the guns to shoot more than 2.5 kilometers because that's as far as they could shoot. I didn't expect the radar to be more sensitive than it is in the F-16. I wanted to know whether we could put the things together into an effective fighting machine quickly.

TR: The problems revealed in the tests didn't bother you?

DELAUER: No. We were getting the software to handle the radar and the guns together.



Most contracts have a cost-sharing clause, so the companies and the government split the savings and the overruns.



If your test is successful, people say it's only one test. If the test doesn't work, they say the project is a failure.

Remember the big flap about the DIVAD homing in on the outhouse? It's *supposed* to. It's supposed to highlight any target creating a Doppler effect, since helicopter blades do that. The outhouse had a fan, so the radar signaled that it was a rotating element. You're not going to find many outhouses with fans on a battlefield.

The critics said the DIVAD couldn't shoot down a helicopter hovering 4 miles away, but so what? In an actual battle the DIVAD crew would not function as an isolated unit. They'd have communications with soldiers sitting in foxholes with Stinger missiles, and the crew would just ask the soldiers to pick off a solitary helicopter. If it were hovering, tanks could shoot it too, and their guns go 22 miles. Meanwhile, a bunch of Soviet aircraft are zipping over the hill at 450 miles an hour—they aren't going to hover 4 miles away—and I'm going to shoot them down with the DIVAD gun.

They conducted the final test in clear weather so the helicopters and planes wouldn't crash into each other, but radar works best in cloudy weather and at night. In clear weather you don't need radar—you can see 4 miles. The testers also jammed the DIVAD's communication system without giving it the standard antijamming equipment. And we hadn't trained all the crews.

This was not intended as an operational test. It was part of a developmental test program to see whether the idea was feasible. However, the critics redefined the program by saying that the DIVAD failed an operational test. It was a hatchet job. All the people in Congress and their staff who'd insisted that the DIVAD program be done in that manner turned their backs on it. The congressional Defense Reform Caucus wanted to kill a program and the DIVAD was the victim. We'd have gotten it deployed in less than 10 years, which was the objective. Watch out—the Bradley fighting vehicle will be the next target.

Congress isn't interested in understanding what a particular test or test program is really for. If your test is successful, people say it's only one test. If the test doesn't work, they say the project is a failure. The day a system works as designed is the day the design is proven. Then the issue is to find a way to make every system exactly like the one that

passed the test. You've also got to design tests that will ensure that the weapon will work under different conditions.

TR: If it's okay for weapons to "fail" development tests, how do we know they'll work in battle?

DELAUER: We have operational tests every time we run military operations. We have pilots in planes shooting at one another—using cameras—in a simulated dogfight. We even have a Soviet "ready room" with a picture of Lenin. Weapons systems are being used every day and their strengths and weaknesses noted.

TR: So you think the DIVAD would have done better under actual battlefield conditions?

DELAUER: Absolutely. At TRW we developed the Beta system for analyzing battlefield data from sensors to locate targets. It failed its development test because we overloaded it with enough data to simulate World War III, as required in the specs for the system. But it worked great when NATO forces used it during their annual exercises, where the data rates were more realistic. Gen. Rogers, head of NATO forces, wanted even more Betas as soon as possible. Getting the system in operation early, before it passed the penultimate test of somebody's (usually a critic's) view of how it should work, allowed it to contribute in a useful way.

Too Few Bullets and Too Many Ships?

TR: Is the military spending too much on weapons and not enough provisioning them with ammunition?

DELAUER: We submit a five-year plan every year, and if you read it everything looks fine. But plans change—they should—and we submit a new five-year plan every year. The problem is that the largest amount of ammunition is always budgeted for the fifth year. More funds should be budgeted for buying ammunition each year instead of waiting until the end.

TR: That problem could be aggravated if the defense budget is cut back this year.

DELAUER: Absolutely, because Gramm-Rudman limits actual outlays, not budget authority. That will affect operations and maintenance, as well as the number of people in the armed services and their pay, not the long-term development programs.

TR: What is wrong with Secretary Lehman's goal of creating a 600-ship navy?

DELAUER: Most service leaders are biased toward "force structure." I think there should be a realistic balance among force structure, modernization efforts, and maintaining a technological base. The air force is pushing to get from 35 to 44 wings of fighter aircraft. I'd rather have 35 wings equipped with modern weapons and a high degree of survivability, and I'd put more money put into the tech base for the next period of modernization in the mid-1990s. It's the same with the navy's goal of reaching 600 ships. Why aren't 575 enough?

But my argument isn't really with the number of ships. I just don't think the United States needs more carrier battle groups. Aircraft carriers themselves are great for peacetime force protection, and they are highly survivable unless we fight the Soviet Union. If we don't fight the Soviets, we don't need all that support. If it's wartime with the Soviets, get those carriers away from their territory. They would sink them—a surface ship has never survived extensive land-based attack. What we need to fight the Soviets is stronger sea lines of communication, anti-submarine-warfare ships to resupply Europe, and more air defense against Soviet land-based bombers.

TR: Why didn't more people challenge the idea that we need more carrier battle groups?

DELAUER: The navy's own people challenged it. The Navy Science Board of the National Academy of Sciences said the idea is a disaster, but that conclusion was ignored.

TR: Didn't the *New York Times* cover the issue?

DELAUER: No. The *New York Times* isn't interested in the whole truth if it doesn't support the editors' biases.

Presidential Secrecy Order Gets No Defense

Congress takes a hard look at the Administration's proposal to greatly expand powers of classification

Security Controls Hurt Research, NAS Warns

A panel of the National Academy of Sciences has said that efforts to restrict open communication are counterproductive

to gain Western technology. There also is good evidence of technology being lost to the Soviets. But, said the panel, "evidence on the military significance of defense on the military significance of science is largely fragmented."

Administration Grapples with Export Controls

The White House and DOD are finally attempting to develop a coherent policy for restricting unclassified but militarily sensitive scientific data

DeLauer Questions DOD Censorship

In February 1980, in the aftermath of the Soviet invasion of Czechoslovakia, the Carter Administration issued a report on the federal government's policy on the control of information. The report, titled "State Department Information Policy," was a response to a request from the House of Representatives for a study of the federal government's policy on the control of information. The report was a response to a request from the House of Representatives for a study of the federal government's policy on the control of information.

Richard DeLauer, the Pentagon's top scientist, last week announced himself from recent proposals to control the publication of unclassified but potentially sensitive papers arising from university research. Speaking at a meeting of the DOD-University Forum, a twice-yearly session involving several university presidents and Defense Department officials, DeLauer took issue with the very notion that there should be a special category of unclassified research requiring restrictions. Defense contracts with universities should be either classified or unclassified, with no publication controls, he said.

The Department of Defense recently proposed that university scientists working on defense contracts in sensitive areas of applied research and exploratory development should submit their papers to the Pentagon for clearance 90 days before sending them to a journal for publication. The laboratory approval for publication (Science, 13 April, p. 134). Leo Young, director of the office of research and development in the Pentagon, estimates that these restrictions would apply to perhaps 1 percent of the contracts between the department and the universities. These proposals have sparked protests from the universities. California Institute of Technology of Stanford, MIT, and DeLauer and George Keyworth, President Reagan's science adviser, stating that "absent any change in research policy—which we regard as very unlikely—our institutions would be unable to accept any research contracts subject to such a restriction."

When the matter was brought up at the forum meeting, DeLauer initially said he did not understand the problem. If publication restrictions were written into contracts, universities could decide whether to accept them on those terms, he said. Several university presidents pointed out that major research universities would not code such publication to any such

September by the National Academy of Sciences that was put together by a committee chaired by Dale Corson, president emeritus of Cornell University; a panel in April by the DOD—

DeLauer found some support from Robert Cooper, director of the Defense Advanced Research Projects Agency, who called the idea of sending even 1 percent of university research papers to the Pentagon for prepublication clearance "a prescription for stagnation." This put both men in opposition to Edith Martin, deputy under secretary of defense for research and advanced technology, who chaired a committee that came up with the proposal for prepublication approval and had just defended it to the forum. Martin, who is DeLauer's deputy, chairs a panel within the department that will implement whatever policy is finally adopted.

Richard DeLauer
Challenged the notion that DOD should approve the publication of unclassified research papers.



Controls on Information

TR: There was a lot of controversy over the Reagan administration's attempts to restrict publication of government-funded university research by classifying it.

DELAUER: We won that one.

TR: You're referring to the policy you established before you left, whereby unclassified basic research at universities would not be retroactively controlled. You think that policy is secure?

DELAUER: Sure. The president issued a National Security Directive to that effect, and that's the best thing that can happen around this town.

TR: Some people think that the phrase "except as required by law," included in the presidential directive, is a loophole.

The president has said that basic research at universities will not be classified after the fact.



*Foreign
nationals
should have
full access to
unclassified
scientific
meetings.*

DELAUER: That provision refers to laws that apply before a research contract is signed, such as those that require the study of atomic energy to be classified. That doesn't mean that unclassified research, such as on semiconductors or multiprocessing, won't eventually lead to a program to design a weapon that has to be classified. But then it's applied technology, not basic research. At that stage universities can decide not to accept such work.

The best example of cooperation on these issues is the system we worked out for encryption research. The National Security Agency (NSA) wanted to review even the encryption research that wasn't done under government contract, and mathematicians at the University of Wisconsin were upset. They finally made a deal with Bobby Inman, then head of the NSA, that they would simultaneously send the agency a copy of any paper that they submitted for publication.

TR: What is the purpose of that review?

DELAUER: The agency may tell the scientists if some of the information they are going to publish is important to national security, and the two groups try to work something out. In other cases the NSA uses the review as a way to keep up with the latest research.

TR: Don't a lot of Defense Department contracts have prepublication review clauses?

DELAUER: Some do, but again, universities can decide not to accept those contracts.

TR: It's easier for elite schools to turn down such contracts than for others to do so.

DELAUER: You bet, but many good universities do accept classified research. Some of the elite schools are smug. They have never had to face hard times.

TR: Many people are concerned about the restrictions the Defense Department may place on foreign graduate students working in the United States.

DELAUER: Participation in basic research is not restricted. There are a few exceptions, such as the Pentagon's VHSIC [very high speed integrated circuits] program. Congress restricted foreign nationals from access to that

work by stating that it comes under the Information Trade in Arms Regulations. I believe doing that was a bad idea, but it was necessary to get the money for VHSIC through Congress.

For most classified research, it doesn't matter if researchers are a foreign citizens. If they've got security clearance, they've got full access. We've got relationships with the Europeans and others on every aspect of classified research, including nuclear tests. Foreign nationals should also have full access to unclassified scientific meetings. Sometimes they are excluded, which is nonsense—everybody will find out about the subject anyway.

TR: You advised the State and Commerce Departments on which technologies would pose a security problem if sold to Eastern bloc nations. That meant you had to review exports included on the Militarily Critical Technologies List, which is 700 pages long.

DELAUER: We reviewed 200 cases a day.

TR: Do you think that list is unwieldy?

DELAUER: Yes, but it's useful in providing a link between the government and exporters. They exercise more care before they apply for a license if their product is on the list.

TR: Did you get a lot of complaints from U.S. manufacturers when you decided not to approve their products for export?

DELAUER: Sure. I thought Caterpillar was going to burn down Washington when their request to sell tractors to the Soviets for their natural-gas pipeline was denied. I didn't support that decision since the technology wasn't that critical and somebody else would have sold the machines to the Soviets anyway. It would have been different if the United States had developed something unique, but the Japanese build tractors just like Caterpillar's, and they sold the Soviets a bunch of them.

TR: Haven't the Europeans complained that they don't always have easy access to U.S. technologies because of export restrictions?

DELAUER: They complained when the hardliners in the Defense Department tried to restrict a British company from selling a turbine licensed from GE to the Soviets. The hard-

liners argued that since the firm had licensed the turbine from a U.S. company, the United States could control its ultimate destination. That was also a dumb move because the Soviets could go somewhere else for the turbine.

Economic embargoes are almost impossible to enforce, and the U.S. depends on trade for its economic vitality. We've got to find other ways of promoting foreign-policy goals.

I do think we should control the export of advanced computer chips, communications algorithms, and equipment used in electronic warfare—technologies with direct military application. But an Apple computer is not a military technology, and that's what Assistant Secretary of Defense Richard Perle argued before Congress. He tried to show how the Soviets could use it to target their nuclear weapons. That's nonsense—those targeting equations are well known and can be solved graphically. Perle's office wants to obstruct the process so that deciding whether to export something takes forever. He held up a license application from Norway, which wanted to use a U.S. process for making temperature-resistant engine parts. He wanted to pressure the Norwegians to work out some kind of political trade. When he finally decided to approve the license, they told him to stick it in his ear—they had obtained the technology someplace else.

Deterrence and the Soviet System

TR: Right before the Geneva summit, the president reiterated his claim that Star Wars will be a leakproof shield to defend people instead of missiles. You have said that developing such a shield would require an effort equivalent to six Manhattan Projects, and that it could be overwhelmed if the Soviets deploy enough offensive missiles.

DELAUER: First, the president changed his rhetoric: he didn't say that we're going to defend the whole U.S. population.

TR: What are we going to do?

DELAUER: We need a deterrent creditable enough to keep the peace, and SDI could contribute to that. The program can provide a degree of survivability for land-based missiles to prevent the Soviets from even thinking of making a preemptive strike.

Such a defense might *not* be overwhelmed by proliferation. If the offensive missiles cost too much, it may not be economical to build them. We might also be able to negotiate a treaty to prevent the Soviets from building extra missiles. So a certain amount of defense is useful.

TR: In other words, you want to improve deterrence. If the United States decides to deploy the mobile Midgetman missile, which would be difficult for the Soviets to wipe out, then a defensive system would become less important.

DELAUER: Right. But I think the single-warhead Midgetman could prove to be too expensive. It just happens that putting a lot of warheads on big missiles such as the MX is the cheapest land-based system. I supported the dense-pack—a hundred MXs packed together in super-hard silos—which was designed to limit the effectiveness of a Soviet attack. The one thing that I as a technologist can do is make sure that U.S. missiles have a high degree of survivability.

TR: You're an advocate of advanced conventional weapons, which use sophisticated surveillance and "smart bombs" to hit targets.

DELAUER: Those that incorporate the West's technical lead in microelectronics give us the biggest advantage. The Assault Breaker program has everything I'm talking about: it includes remote-piloted vehicles for surveillance and targeting, and missiles that carry smart munitions to hit moving targets.

TR: Have these advanced conventional weapons actually worked?

DELAUER: Some have, some haven't. The Maverick air-to-ground missile is coming along pretty well. The laser-guided bombs have had some problems. The Libyan attack revealed some deficiencies in their sensing systems. But overall the attack went pretty well—it was a complex operation involving a large number of aircraft.

TR: Some say that if we use conventional weapons to hit the Soviets' command centers and troops behind the lines, they might escalate to nuclear war.

(Continued on page 71)



*E*conomic
embargoes are
almost impossible
to enforce. We've
got to find other
ways to promote
our foreign-
policy goals.

Whatever your cup of



Rose Hip Tea
Copenhagen, Denmark



Black Sea Tea
Istanbul, Turkey



Earl Grey
London, England



Green Tea
Osaka, Japan



Tea Cider
Stuttgart, West Germany



Camomile Tea
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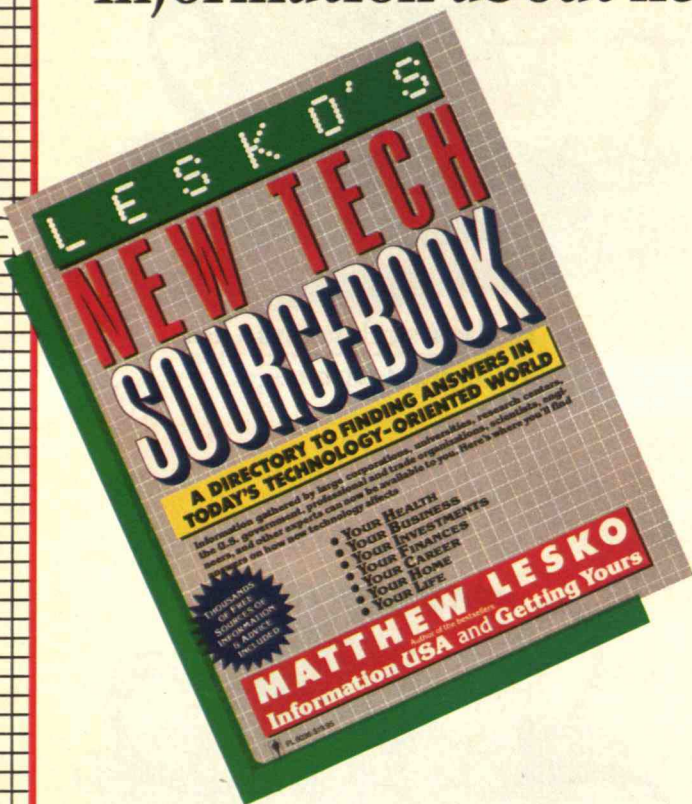
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DELAUER: Advanced conventional weapons should allow our side some options so that *we* don't have to escalate to nuclear war.

What people fail to realize in talking about defending against the Soviets is that they use their military system to reinforce their economic and political aims. At present it's the only way they have of keeping all their people employed. The Soviets have a huge standing army, and it's not used to protect the Chinese border—elite forces do that. The standing army is used to homogenize and indoctrinate their young people. That effort will become even more important as the Soviet Union becomes largely Moslem, especially if Moslem fundamentalists keep exporting revolution. Putting kids into the army is a good way to get them off the street.

TR: Can't the Soviets put people to work building houses?

DELAUER: They could but they aren't. In the United States, the people working in the defense sector don't live any differently from those working in other areas. But the Soviet military elite does, and it wants to preserve the status quo. The whole system would have to change for the Soviets to produce more consumer goods.

Around the time when former Premier Andropov tried to move some top military managers into the industrial sector, the Soviet military shot down the Korean airliner. When Krushchev tried to reform the system, a Bulgarian agent was murdered in London. There may have been a connection. The military might have created those crises so that reform efforts would be curtailed.

Soviet military technology is pretty good because it's produced by multidisciplinary teams. But civilian efforts are organized very rigidly and hierarchically. There's an institute for electrical engineering and one for mechanical engineering, and the different groups don't communicate. When the head of the Soviet Union's only center for computer research visited us at TRW, he was surprised to see engineers and technicians working in our computer lab. He told me that their computer facility is run only by mathematicians. No wonder their computers don't work very well. We wanted to know how they could design nuclear weapons without advanced computers. It turns out that

their smart mathematicians figure out how to do it without good machines. That's a tough way to operate.

TR: After you left the Defense Department your job was divided into two positions, one for R&D and one for acquisitions. Was that a good idea?

DELAUER: There is no real separation between the acquisitions process and R&D, so why separate the responsibility? Separation reinforces the notion that there is a line between developing a weapon and producing it, when in fact they are interconnected, and should be more so. Combining the jobs also gives the R&D chief more authority to argue for specific programs, to balance the influence of the secretaries of the military services.

TR: Do you think the Packard Commission report on reorganizing the Defense Department, which has received support from the president and Congress, is going to have a positive effect?

DELAUER: Yes. The most significant change is the reorganization of the joint chiefs. Instead of giving all the chiefs direct access to the president, the chairman of the joint chiefs will be the principal military advisor to the president. Those provisions will weaken the services' hand a little.

Also, under the present setup, every vote by the joint chiefs on specific weapons has to be unanimous. That's a lousy way to set joint requirements because each service pushes for what it wants. An example of that was JSTARS—the U.S. Army/Air Force Joint Surveillance and Target Acquisition Radar System for targeting conventional missiles. The air force and the army each wanted the system to have different capabilities, and in a weak compromise they decided to produce two different versions. I also found that eight programs in the different services were working on producing a remote-piloted vehicle [RPV], even though the army was the only one that had a stated requirement for such a vehicle. Now there are only three RPV programs. Under the new system the chairman will be able to get independent advice to decide which programs to recommend, and the staff will focus on supporting the chairman instead of all the chiefs. □



*The Soviet elite
wants to preserve
the status quo:
they don't want
to produce
more consumer
goods.*

Such an increase will require that interested agencies designate at least one senior staff member to oversee their negotiation work. These staff members will have to keep up to date with the latest breakthroughs in negotiation. Also, agencies will need additional appropriations to fund the collaborative technical studies that negotiators may call for. Extra money may be necessary to help some negotiators attend meetings as well. Typically, an agency that hopes to negotiate five rules a year might need to budget \$250,000 or more annually for them.

Regulatory negotiation doesn't have to stop with negotiated rule-making. Permitting, licensing, and rate-setting disputes can be resolved through negotiation, too, and this work can be done at the local, state, and federal levels. Consider how negotiation has entered the regulatory arena in New Mexico. That state's Public Utility Commission recently invited a broad range of interested parties to help draft a plan to soften the impact a new nuclear plant will have on utility rates. Without a plan, consumers

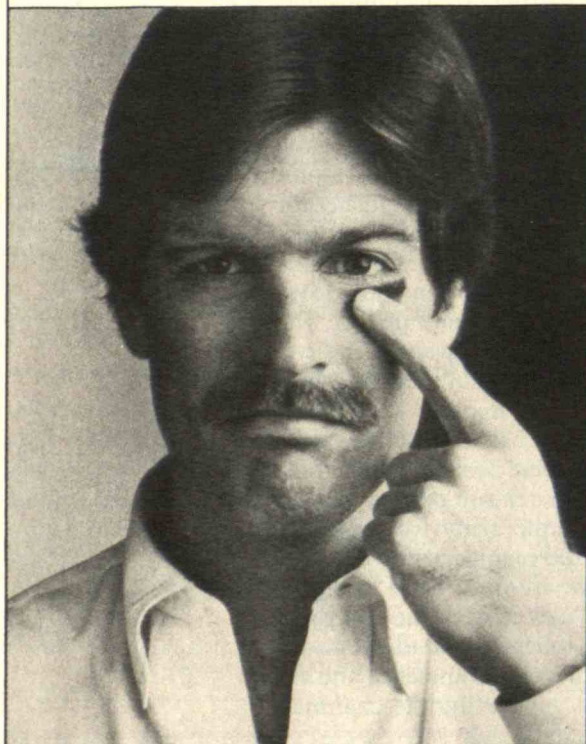
would be hit with significantly higher bills to pay for the plant's construction costs. In Massachusetts, Wisconsin, and Rhode Island, the state legislatures have enacted facility-siting laws requiring that builders of waste-treatment plants negotiate with potential host communities before receiving state licenses.

The key obstacle to more widespread use of negotiation in the regulatory process is doubt as to whether the method can really work. But doubt should not stop lawmakers from testing the technique. There is little to lose, even if negotiation doesn't succeed. Information will have been shared, and differences will have been narrowed. And if negotiation works, the courts' burden will be lessened, costs will be reduced, and the government's legitimacy as a regulator will be improved.

FURTHER READING

- Administrative Conference of the United States, "Procedures for Negotiating Proposed Regulations." December 13, 1985.
- Raiffa, Howard, *The Art of Science of Negotiation*. Cambridge, Mass.: Harvard University Press, 1982.

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However, these uses account for only a small proportion of total demand, since alternatives to helium are often available.

It is also true, as Mattill states, that the cheapest source of helium is combustible natural gas. But sometimes it makes more sense—even economically—to tap other sources. One of the drawbacks of the U.S. helium-purchase program was that it did not allow for purchasing by-product helium. In other words, the government was required to capture and stockpile helium that could have been more cheaply conserved just by leaving it in the ground.

DAVID B. BROOKS
Ottawa, Canada

ARCTIC ADVENTURES

Ladislav Reday's "In Search of the Wandering Magnetic North" (*January*, page 20) contains errors. The manager of the air-charter operation Reday flew with spells his name Jonasson, not Johnson. It was Robert E. Peary (not Perry) who, in all probability, first reached the North Pole. And his exploit did not come in the same year as Cook's. Cook claimed he reached the pole in 1908, Peary in 1909.

Commander James Clark Ross never "trekked" toward the magnetic north pole. Searching for the Northwest Passage, he maneuvered his ships over extremely treacherous waters, but he rarely came ashore for prolonged periods. Also, there is no such place as the "Resolute Island" indicated in the upper of the two maps on page 22. There is a community called Resolute located along the south shore of Cornwallis Island. This island lies directly west of Devon Island, which is the one misnamed Resolute on the map.

Lastly, I would like to point out that poetic license seems to come easy in the Arctic. How else could Reday explain how he saw "tattered remnants" of a camp and—better yet—wooden grave markers from a plane that must have been traveling at an altitude of a thousand feet or higher?

ERWIN STREISINGER
New York, N.Y.

Contrary to Reday's statement, the National Geographic Society did not arbitrate the dispute between Cook and Peary over who reached the North Pole first. Rather, a financial backer of Peary supported his claim.

CHARLES E. BALLEISEN
Dallas, Tex.

Continued on page 79

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Asbestos Workers in Court

Outrageous Misconduct

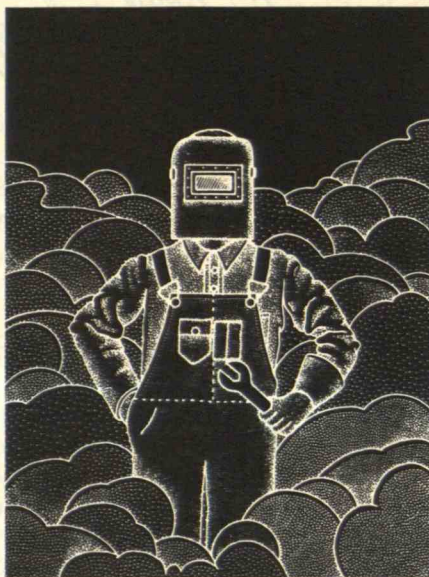
by Paul Brodeur
Pantheon, \$19.95

Reviewed by David Ozonoff

In March of 1980 I received an unusual letter from a New Jersey law firm. The writer identified himself as the national counsel for Raybestos-Manhattan, manufacturer of asbestos textiles and friction products. His clients were defendants in a number of personal-injury suits brought by individuals who alleged that they had contracted asbestosis and other lung diseases from using Raybestos products. Many of these people had been exposed during the 1940s while working in government or private shipyards. The attorney was attempting to locate a medical historian to testify concerning the general state of occupational medicine in the 1930s and 1940s, and inquiries had turned up my name. The attorney concluded that "we would expect to be able to demonstrate that Raybestos-Manhattan has always acted as a responsible member of the corporate community in undertaking to ensure the health and safety of those individuals known to have been at risk from asbestos exposure."

It turned out that I was somewhat familiar with the history of asbestos-related disease, and I had also used *Expendable Americans*, journalist Paul Brodeur's 1973 account of the politics of asbestos regulation, in my teaching. The book is a searing account of corporate callousness and governmental inaction concerning the hazards of asbestos, as well as a record of the needless human suffering that resulted. From what I knew in 1980, the corporate community was aware—or should have been—of the hazards of asbestos by the 1940s. I therefore declined the offer to participate in the Raybestos litigation.

Two months later I came across the letter again while cleaning my chronically littered desk. It struck me as a very odd tactic to hire a historian of medicine as an expert witness. So I passed a copy of the correspondence on to Irving Selikoff, one of the world's leading asbestos researchers, who works at Mount Sinai Hospital's Environmental Sciences Laboratory in New York. Five days later I was contacted by two plaintiffs' attorneys alerted by Dr. Selikoff. From them I learned that there



was not one asbestos case but thousands of them, and I soon was drawn into the complex world of asbestos lawsuits, the most massive tort litigation in the history of American jurisprudence.

In his latest book, *Outrageous Misconduct*, Paul Brodeur tells the labyrinthine story of how this litigation developed from the late 1950s to the point today where four asbestos companies have chosen bankruptcy rather than face the lawsuits. The story, told in excruciating detail and with unconcealed outrage, is even more disheartening than his earlier one because the toll of needless human suffering has now been so thoroughly documented.

Brodeur accurately chronicles the events, personalities, and issues in this unfolding story. His account begins with Ward Stephenson, who first undertook to sue asbestos manufacturers on behalf of a 40-year-old insulation installer from Orange, Tex., in 1965. The law prohibited Stephenson from suing his client's employers directly, because workers' compensation was supposed to provide an exclusive remedy for work-related illness. So Stephenson instead sued the makers of the insulation products that his client used on the job. He did this under a new legal doctrine that held manufacturers strictly liable for the results of selling unreasonably dangerous products to users and consumers. Manufacturers could be ruled accountable if the plaintiffs could prove that a company, held to the standards of an expert, could have foreseen the defec-

tive condition. Industry defendants and their insurers responded to Stephenson's suit by contending that no one knew that asbestos was hazardous until Dr. Selikoff published studies of insulators in 1964.

What followed from this first case was more than a decade of discovery, the legal term for the process whereby one side obtains from its adversary opinions, facts, and documentary evidence pertinent to the case. Through dogged determination, a fair amount of luck, and no little ingenuity on the part of numerous plaintiffs' attorneys, a picture of extensive corporate knowledge of asbestos hazards began to emerge, and with it a consistent pattern of coverup and deception.

The attorneys found that insulators had filed workers' compensation claims for asbestos-related disease beginning in the 1950s. Other evidence revealed that the industry had detailed knowledge of the burgeoning medical literature on asbestos disease, had themselves sponsored research on the subject but not published the results, and had influenced scientists to downplay the hazards of asbestos in journal articles as early as the 1930s. Brodeur provides a fascinating account of how attorneys and others assembled this appalling picture.

He also shows the effects of these discoveries on juries and judges, who began to award punitive damages for reckless and outrageous misconduct on top of higher and higher compensatory awards. He meticulously details the tortuous methods that the industry and its insurers have used to try to evade their liabilities and responsibilities. And he exposes the cynical roles that political figures have played, such as Colorado Sen. Gary Hart's attempt to get Johns-Manville Corp. off the hook and onto the public tax bill. (Manville headquarters are in Colorado.)

Future Risks

Brodeur raises provocative questions about whether the rights of future asbestos victims will be preserved if companies continue to seek protection under federal bankruptcy laws. Johns-Manville devised a financial reorganization plan that included a fund to compensate present and future claimants, but the plan has not been approved by representatives of the company's shareholders. Brodeur also wonders whether the asbestos disaster will motivate industry to avoid such irrespon-



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THE NEW REPUBLIC

The warriors' world is without complexity, of black and white, of good and evil, with absolutely no middle ground.

sible behavior in the future. The outlook is not good, since the insurance industry and manufacturers are promoting "no-fault" compensation schemes that would award fixed amounts in such cases. The insurance industry claims that a no-fault system is necessary because liability awards have skyrocketed to unrealistic levels. However, economist Leslie Boden estimates that victims recover less than one-third of their lost wages and household services under the tort system. Moreover, if asbestos victims had not been able to win significant damage awards, the risks and extent of asbestos exposure might never have become known. Certainly the industry's coverup would never have come to light.

Brodeur gives us an extensive discussion of these complex policy issues, but to his credit he never lets us forget the terrible suffering of asbestos victims and the callousness of those who caused it. Dr. Selikoff has estimated that in the three decades beginning in 1980 as many as 270,000 people may die of asbestos-related cancer. To remind us of the human beings behind this mind-numbing figure, the book ends with excerpts from letters written by the widows of asbestos workers in reply to inquiries by Dr. Selikoff for his ongoing mortality studies. Here is the last of them:

"He died the night he came home from the hospital. He came home and sat up. He even got on his feet. The doctors shook their heads. They couldn't believe it. He tried to get well. He loved life and he wanted to live for me and the kids. He laid down and when his last breath went out, he called me and said, 'Honey, I'm dying.' Then he died."

DAVID OZONOFF is chief of the Environmental Health Section of Boston University School of Public Health.

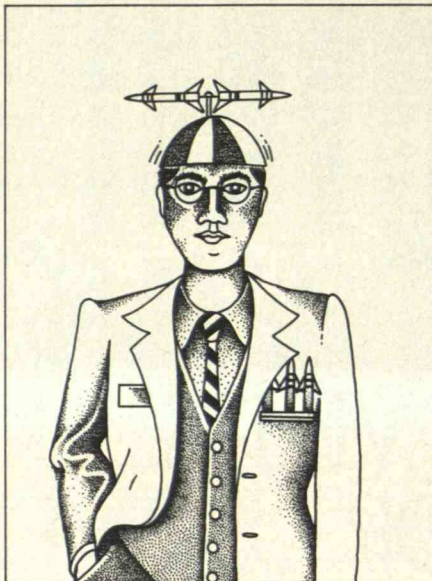
Defense Wizards

Star Warriors

by William J. Broad
Simon & Schuster, \$16.95

Reviewed by Michael Riordan

William J. Broad has written a remarkable, riveting book. *Star Warriors* is an intimate portrait of O Group, a small, closely knit team of young scientists at California's Lawrence Livermore Labo-



ratory who have developed many of the key ideas, designs, and inventions essential to the Strategic Defense Initiative. Led by Lowell Wood, outspoken protégé of H-bomb advocate Edward Teller, these whiz-kids are laying the groundwork for a "third generation" of nuclear weaponry—the "directed-energy" weapons based on x-ray lasers that their creators expect will render offensive missiles obsolete.

A *New York Times* reporter, Broad writes extensively on science and technology, especially their political dimensions. His *Betrayers of the Truth*, co-authored in 1982 with Nicholas Wade, is a penetrating exposé of scientific fraud. *Star Warriors* chronicles a week Broad spent with the wizards of O Group in May 1984, tagging along with them through all-night research bouts and frequent trips to local fast-food outlets, interviewing, probing, and questioning.

It is easy to be swayed by the idealism of these youths—most of them under 30 and recent graduates of Caltech or M.I.T.—and Broad at times is. "Warriors," he notes, "are intrinsically more interesting than worriers." Crusaders of a modern scientific religion, they are doing their best to develop the *technical* means to avert a nuclear horror they had no part in making. What can possibly be wrong with working on defensive weapons whose principal aim is to save lives, not end them?

But as Broad probes deeper, he repeatedly encounters a shallowness in the war-

riors' perceptions of the world beyond Livermore. Cloistered in this otherwise sleepy burg, nurtured by the fatherly Wood, their lives revolve about defense work and one another, leaving scant room for outside stimulation. Few have any other friendships, let alone romantic relationships, in their lives. Their reading seldom goes beyond the pages of *Aviation Week* or science-fiction pulps. Their most pressing social dilemma is the daily debate over whether to eat dinner at MacDonald's or Burger King.

Theirs is a world without complexity, of black and white, of good and evil, with absolutely no middle ground. Rodney Hyde hates the Soviets because he considers them intrinsically opposed to technology; they would sabotage his dreams of interplanetary space travel if they ever took over. To other warriors the Soviets are merely ogres bent on world domination, whatever the cost. Such perceptions, built on extremely limited personal experience, go unchallenged in what Broad aptly terms the "high-tech gulag" of Lawrence Livermore Laboratory.

The exception to this norm is Peter Hagelstein, inventor of the nuclear-pumped x-ray laser at the heart of the current enthusiasm over Star Wars. The Hamlet of this piece, he reads French and Russian literature and played piano and violin in a symphony orchestra while a student at M.I.T. He comes to Livermore not to work on weapons but to develop an x-ray laser for medical research. But after his girlfriend leaves him over his defense work, Peter becomes thoroughly entangled in the pressures and drives of O Group, the only "society" he knows. His pivotal invention is largely the result of bitter competition with a Livermore rival. He finds little solace in what he has wrought.

In the airless environment of O Group, it is easy to perceive the solutions to extremely knotty world problems as purely technical. The complexities of nuclear politics escape these warriors, who cannot imagine that their inventions might make nuclear warfare *more* likely, not less. "Would computer errors and false alerts start an accidental war on an enemy's satellites and battle stations with x-ray lasers?" Broad asks finally, "And would an enemy suddenly deaf, blind and dumb unleash its nuclear arsenal?"

None of this activity would be particularly troubling were it not for the impact

that this brand of "technological optimism" has been having at the highest levels in Washington. Through the medium of George A. Keyworth II, President Reagan's former science advisor and a close ally of Teller's, this brash, damn-the-torpedoes mentality has been informing U.S. science and defense policymaking for several years. The vast majority of the U.S. scientific community, which doubts Star Wars can ever work, was never asked to review the program. So billions that could be spent in much more productive pursuits may now be squandered in a new round of the spiraling arms race, one that will probably leave us *less* secure than before.

Reading *Star Warriors* has only reinforced my own conviction that the solution to our nuclear dilemma, if one exists, is not technical but political. Both sides have so much to gain by reaching an accommodation that there must be a way. William Broad has made a valuable, durable contribution to the literature of this quest; his book deserves a careful reading by everyone interested in finding that way.

A physicist with the University of Rochester, MICHAEL RIORDAN is the author of The Hunting of the Quark, a history of particle physics (Simon & Schuster, forthcoming).

Colonizing Space

The Space Colonist's Handbook

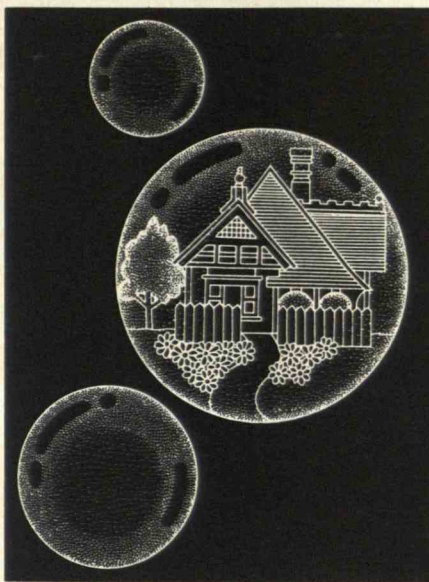
by G. Harry Stine

Holt, Rinehart & Winston, \$11.95

Reviewed by Jack Kirwan

The main problem with the U.S. space program is that it has never had a clear, long-range purpose. The Apollo program to put humanity on the moon was a dazzling tactical success in terms of beating the Russians, but it was a cul-de-sac in terms of devising a strategy for the ongoing use of space. Still, a few scientists, politicians, and writers have maintained a vision of space as the next logical extension for the human race. One of these thinkers is G. Harry Stine, an engineer, writer of science fiction, and now the author of *The Space Colonist's Handbook*.

While space colonies began as science fiction, the concept is now as real as bacon and eggs (or caviar and vodka, considering how much more experience the Soviets have in long-term space habitation). The



basic scenario for moving people into space is to build a toehold with a space station and then add to it as opportunity permits. Today it's easier to dock modules together in orbit than to build structures from scratch in space. But, says Stine, in time "space activities will require workers skilled in assembling structures either from parts lifted up from Earth or from assemblies fabricated in space from extraterrestrial materials." These workers will be out in force if the United States proceeds with industrializing space or building giant solar power satellites. Given a reasonably strong commitment to such activities, people could be living and working in space by the year 2000.

The bulk of Stine's book is a nuts-and-bolts look at the serious problems of existing comfortably in space. For openers, doing so would require creating a totally artificial atmosphere with the right pressure, composition, and temperature. And we're not just talking about living in a space suit. Happily, creating such an environment appears to present no major engineering problems. However, protecting people from the hazards of ionizing radiation—both the radiation that exists in space and the enhanced radiation from solar flares—will be one of the most important considerations.

Weightlessness will also present a problem, since bone decalcification occurs when humans live in near-zero gravity. Bones don't have to be as strong, so they lose calcium, which is released into the

blood. This results in hypercalcemia, a condition that can cause nausea, vomiting, abdominal pain, and even death. Hypercalcemia is treatable on Earth, so Stine is optimistic that ways to deal with it in space will also be found, but he warns that someone is going to have to start working on the problem soon. Of course, weightlessness is not necessarily only a curse: it could possibly add years to the lives of the elderly and people with weak hearts.

Many of these hazards have long been recognized. Stine is most provocative when he describes the social concerns of living and working in space, including the organization of space colonies. Stine predicts that early settlers will be organized into "quasi-military, authoritarian hierarchies" that reflect "the paramilitary nature of the early space programs of both the United States and the Soviet Union." He doesn't think that is necessarily bad, since such organizations have been developed to ensure the performance, safety, and health of highly trained people living and working in dangerous, isolated environments. When multinational corporations establish operations in space, Stine expects them to use the bureaucratic management techniques that they rely on on Earth. But eventually, as people see space as their primary home, they will evolve their own forms of social organization.

Stine also points out that these colonies will have to develop their own monetary and legal systems. Instead of using cash, space inhabitants will probably trade work chits for goods and services. Many items such as toilet paper that are cheap and plentiful on Earth will undoubtedly be far more valuable "up there." Deciding what to do with criminals will be difficult, since shipping them back to Earth would be expensive and putting them in jail would waste precious space and skilled labor.

As Stine says, space is for people, not machines, and the environments and machines of space must be designed to accommodate humans comfortably over the long haul. This handbook will give those already sold on the idea of living in space the latest information on the complexities of doing so. And it may even convince skeptics to consider thinking of space as their next home.

JACK KIRWAN is assistant editor of The Energy Journal, published at the University of Arizona at Tucson.

Continued from page 55

to the towns and try to find jobs. If there are none, we end up living out here on welfare.

Land, Ceremony, and Sacred Places

The Navajo's great attachment to the land is inextricable from religion and ceremony. For many Traditional Navajo, as well as those of the Native American Church, ceremonies are often tied to the land. Sacred places exist throughout the area. Some of these places, such as the Four Sacred Mountains—Blanco Peak, Colo.; Mount Taylor, N. Mex.; Mount Humphreys, Ariz.; and Mount Hesperus, Colo.—are known to all Navajo. They mark the ceremonial and traditional boundary of the Navajo world. The mountains protect the Navajo from chaos and confusion, as 75-year-old Albert Francis, Sr., describes:

The mountains surround us and protect us because they are the sacred legends, prayers, and the air we breathe, which is life. Here we are told, "This is life," and as our parents pass on they put it in our hands and say, "The time has come for you to take over and carry on."

Despite disputes over the land, some Navajo and Hopi clans have shared obligations in ceremonies. In fact, the presence of each is indispensable for tobacco-smoking and planting ceremonies. Both Navajo and Hopi must be present to share ritual sacred objects from other ceremonies as well. With relocation, stock reduction, and the fencing of the land, these ties have been weakened. Jennie Paddock suggests that depression is the cause:

Since the fencing six years ago, we all just keep to ourselves. Some Hopi ask, "Why don't you come by anymore?" but I just can't bring myself to say why. No harsh words or anything. We just keep to ourselves. I wish things would go back to the way they were.

Much has been written about Navajo ceremonial life. Most authors describe the healing value of the ceremonies, discussing only tangentially their importance for teaching and upbringing. But embedded in ceremonies, which refer to legends describing important events, are two key



Katherine Smith's basket holds ritual objects symbolizing the sacredness of the land.

pieces of information: why things are the way they are, and how individuals should behave to maintain harmony with the world.

When livestock is taken away, people no longer can support ceremonies. This is not because the medicine men who conduct them charge too much, since some will conduct a ceremony regardless of what is given them. Rather, the people are so ashamed and depressed over their situation that they cannot bring themselves to sponsor the ceremonies.

When people are forced to abandon their sacred places, the effects are just as dramatic. Legends are associated with geographical features, and children traditionally learn many legends by walking about the land with their parents or grandparents. The land is like a map, helping people organize and remember a body of unwritten knowledge.

The relocation and stock reductions also undermine the credibility of local leaders. This further weakens the Navajo's ability to help themselves, contributing to the dissolution of the community. Jerry Goldtooth tells how the federal programs made Navajo leaders the resented bearers of bad news:

Sometimes it seems like [our leaders] are on their [the Hopi's] side. They don't try hard enough for us. . . . So we take the tensions out on the leaders, but they really don't know what's going on.

Symptoms of Suffering

Because of relocation, stock reduction, and the fencing of the land, the Navajo cannot conduct the life to which they were accustomed. Nor can they impart the fundamentals of this life to their children. To make matters worse, they can't even modernize on their own terms. They thus suffer severe depression, with all its usual symptoms: loss of appetite, sleeplessness, vulnerability to disease, forgetfulness, inability to concentrate on simple tasks, partial paralysis, and early death. Martin Topper, an anthropologist with the Indian Health Service, says that the rates of reported depression, suicide attempts, and alcohol-related violence have risen as much as eight times over what would be expected from that Navajo population.

Frank Goldtooth gives a telling account of his feelings:

We feel like jackrabbits: no real home. We sleep anywhere. My tools lie about collecting dust. So do the horse trailers, reins, and saddles. When I look around when I go outside I wish to see sheep. I still have some hope that they will come back some day. It hurts my heart like it has been taken out. It is like dying while still living. We just pray every day. I cry when I start thinking about what life used to be like with us.

The younger, better-educated adults report tension and frustration over the plight of their families. Their own loneliness troubles them, too. Jerry Goldtooth's younger brother Edison describes his frustration:

We used to do cow roping on weekends. It relieved tension. Now it's all bottled up inside us. There is nothing to do.

Parents have no education. It really bothers me. We can find a job, but they just can't go and do something different.

It makes me feel like beating up somebody or something. We take out the tension on the leaders, but they don't know what's going on either. I can't do much now. □

"In Search of the Wandering Magnetic North" (*January page 20*) is an adventure story. Whoopee! I was awed by the pictures, especially the one of North America's northernmost community, Grise Fiord.

DON WEIR
Beverly Hills, Calif.

"In Search of the Magnetic North" features two questionable pictures of icebergs. Icebergs are relatively rare in the North American Arctic. Also, the one on page 25 was probably not photographed during the author's trip: I find it very hard to imagine any place where there would have been so much unfrozen water in the month that he traveled to the pole.

The author says his Twin Otter plane carried six drums of fuel. This is highly unlikely, considering the probable weight of the passengers and their gear.

Moreover, the statement that the "frozen Arctic Ocean moves in a vast clockwise circle around the North Pole" is misleading. In reality, several forces are at work in polar waters. The Beaufort Gyral is a seven- to ten-year drift clockwise around the Beaufort Sea. Ice at the North Pole may or may not be caught in this drift, depending on the storms and winds prevalent at the time. The Transpolar Drift starts somewhere near the East Siberian Sea and ends between Greenland and Svalbard roughly three years later. There are other currents in the Arctic as well.

One more error occurs in the caption on page 23, which calls Grise Fiord the northernmost community in North America. By my map, Qanag on the west coast of Greenland is farther north.

CARL A. WALES
San Diego, Calif.

Reday's fascinating narrative is full of high-quality technical observations. Such information could be invaluable in future geomagnetic explorations.

ALBERT J. PUSCHIN
Barrington, R.I.

The author responds:

I apologize for the errors in my article. I especially regret that Peary's name was spelled incorrectly.

But for the record, I *did* see the camp of the Franklin expedition, as well as the grave markers. I have pictures of them taken from the plane—without a tele-scopic lens. □

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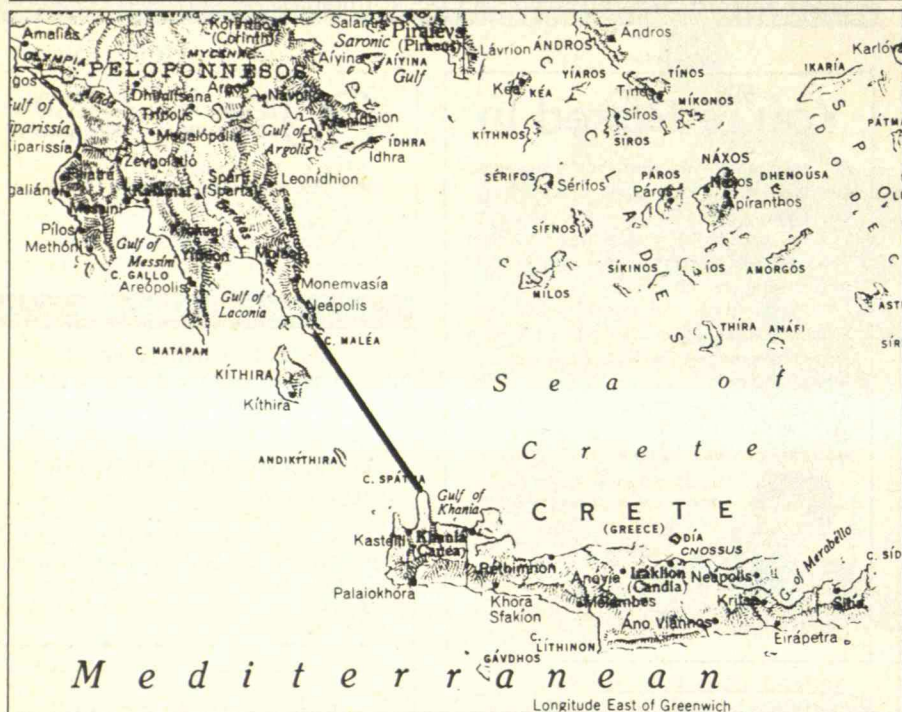
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Daedalus Reborn



The shortest distance from Crete to Greece is 69 miles—three times further than the 1979 human-powered cross-Channel flight by *Gossamer Albatross*. But an M.I.T.-Smithsonian feasibility study says that a human-powered aircraft could fly that route, and this summer faculty and students at M.I.T. are designing and building a prototype of the plane that will attempt the flight.

The feasibility study was the first phase of Daedalus, an M.I.T. project named after the mythical Greek inventor who flew to Athens from imprisonment on Crete. Daedalus used wings he had fashioned himself.

About half the \$195,000 required to build the prototype has been guaranteed by Anheuser-Busch, and the aircraft will be called the *Michelob Light Eagle*. As work began, the builders' goal was to fly the *Eagle* from Woods Hole to Martha's Vineyard by the end of the summer.

"The Chances Are Good"

Four key advances led to the optimism of the feasibility study:

- A new wing configuration with 30 percent less drag than that used on previous human-powered aircraft.
- A new wing structure that is stronger

and lighter than any heretofore available.

- An ergometer test indicating that a four-hour flight is humanly possible.
- Meteorological surveys showing a "weather window" in March, April, and September when conditions are likely to be favorable.

"We are confident that chances for completing this historic flight are good," said the M.I.T.-Smithsonian study team.

Like Running a Four-Hour Marathon

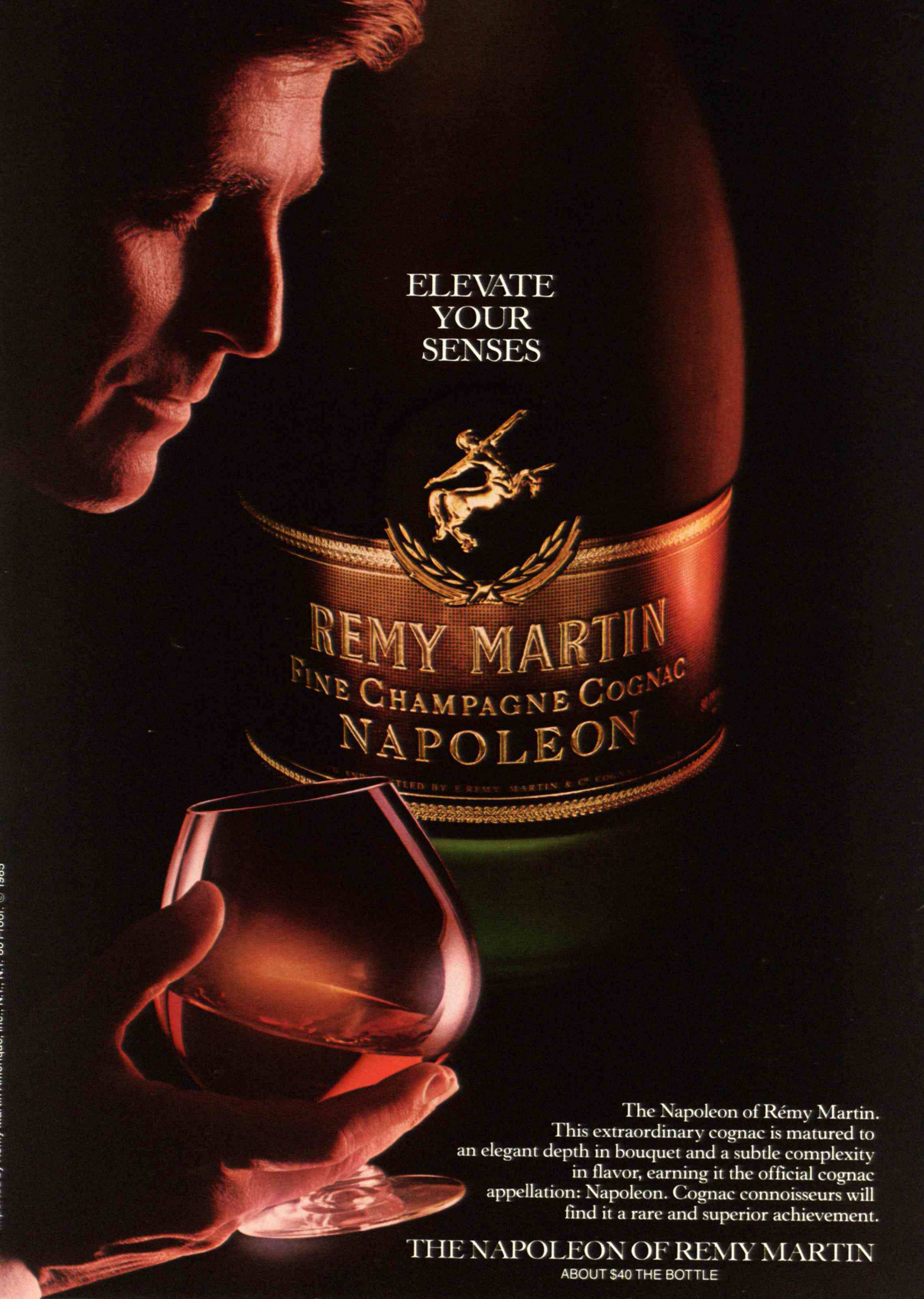
Preliminary plans for the *Michelob Light Eagle* show a 35-foot-long plane with a 102-foot wingspan. It will weigh only 68 pounds, including instruments and an automatic-pilot device. It will have three times more range, 30 percent more speed, and 50 percent more strength in the frame than *Gossamer Albatross*, the human-powered aircraft designed by Paul McCready that now holds the world distance record of about 22 miles.

The *Eagle* will require some 15 percent less power than *Albatross*, according to preliminary estimates. This means the pilot will have to pedal with an effort matching that of a marathon runner at moderate speed. But the effort must be maintained for at least four hours—twice as long as the usual marathon. And that

A human-powered flight from Crete to Greece might come in 1987, John S. Langford of M.I.T. said at a Washington press preview. The flight would set a world distance record.

kind of performance is "pressing the limit . . . an unknown area of human physiology," says Ethan Nadel, professor of physiology at Yale who was a member of the M.I.T.-Smithsonian team. So the Daedalus project may give the field of medicine new information on what athletes can do.

The Daedalus team working at M.I.T. this summer is headed by John S. Langford, a Ph.D. candidate in aeronautics and astronautics. Langford was co-leader of the team that flew M.I.T.'s human-powered *Monarch* to a new world speed record in 1984. Others associated with the *Monarch* project who are now working on *Eagle* are Mark Drela, Boeing Assistant Professor in aeronautics and astronautics at M.I.T.; Stephen L. Finberg, staff engineer at the Charles S. Draper Laboratory, Cambridge; Robert W. Parks, senior research engineer at Lockheed Missiles and Space Co., Lakeland, Fla.; and Harold H. Youngren, research specialist in flight science at Lockheed-California Co., Burbank, Calif. □



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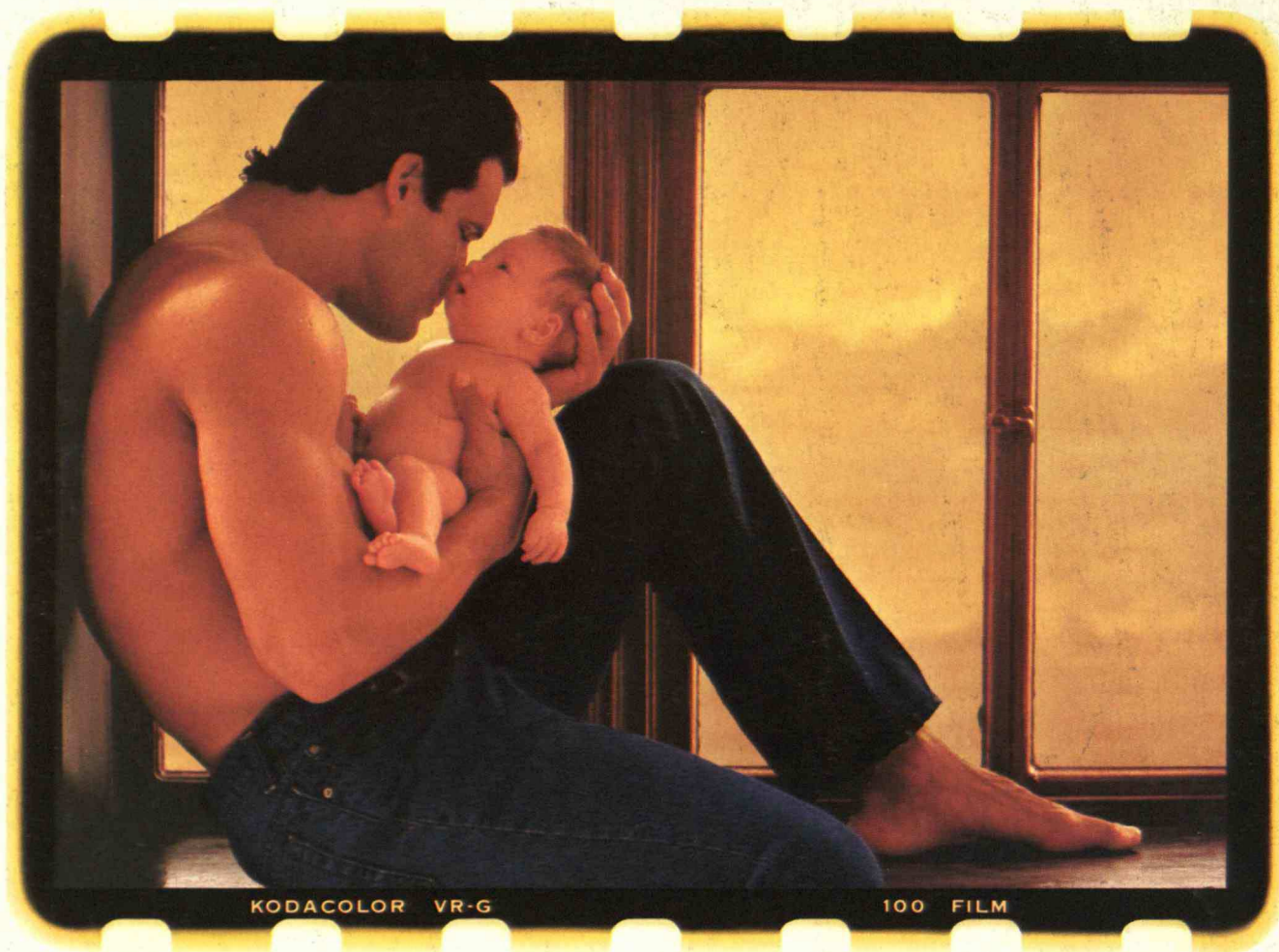
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